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INVESTOR HOMO OECONOMICUS OR HUMAN; WHAT DEVIATES FINANCIAL MARKET DECISIONS FROM RATIONALITY?

BACHELOR THESIS

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Prohlašuji na svou čest, že jsem bakalářskou práci vypracoval samostatně a s použitím uvedené literatury.

Robert Vácha

V Praze, dne 15. 5. 2017

I hereby declare, that I have elaborated my Bachelor Thesis independently and using the stated literature.

Robert Vácha

In Prague, 15. 5. 2017

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Abstract

The thesis deals with the differences among phenomena of Homo Oeconomicus and Human and their presence in the financial markets. Furthermore, it aims at revealing differences of behavior in alignment with the phenomena among groups of people involved and not involved in the financial markets. To do so we use an experiment with its assessment based on the Anchoring Index. For the purpose of the research of behavior in alignment with the Prospect theory, the thesis defines new index of assessment of human behavior the Human Index upon which it draws conclusions about the two groups. The results show no significant difference in propensity to bias and marginal difference in behavior in alignment with the prospect theory where the group involved in the financial markets reveals less Human behavior. Altogether, the findings are no remarkable difference in behavior among the two groups, i.e. both the group of people involved in the financial markets as well as those not involved are Human at very similar levels.

JEL classification: D84, D81, G19, D03

Keywords: Expectations, Decision under risk, Perception Bias, Financial Markets, Behavioral Economics.

Abstrakt

Tato práce se zabývá rozdíly mezi fenomény Homo Oeconomicus a Human a jejich přítomnost na finančních trzích. Dále se zaměřuje na odhalení rozdílů v chování v souladu s těmito fenomény mezi skupinami lidí zapojených do finančních trhů a těmi, kteří se do finančních trhů nezapojují. K tomu používáme experiment s hodnocením založeným na anchoring indexu. Pro účely výzkumu chování v souladu s prospektovou teorií, práce definuje nový index hodnocení lidského chování Human Index, na kterém vyvozuje závěry o těchto dvou skupinách. Výsledky neukazují na významný rozdíl ve sklonu k biasům a marginálnímu rozdílu v chování v souladu s prospektovou teorií, kde skupina, která se podílí na finančních trzích, odhaluje méně chování v souladu s touto teorií. Celkově nejsou zjištěny žádné pozoruhodné rozdíly v chování mezi oběma skupinami, tj. jak skupina lidí, kteří se podílejí na finančních trzích, tak i skupina, která se nepodílí, jsou na velmi podobných úrovních.

JEL klasifikace: JEL classification: D84, D81, G19, D03

Klíčová slova: Očekávání, Rozhodování za risku, Kognitivní zkreslení, Finanční trhy, Behaviorální ekonomie.

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Introduction

The investors in financial markets could in general be perceived as agents disponing with above average rationality given that their work´s main purpose is drawing conclusions, analyzing excessive amount of data, usually with support of whole departments dedicated to this very task. The question hence arises whether investors in the financial markets behave in accordance with the concept of Homo Oeconomicus or vice versa the Human. The motivation to choose this topic has arisen from my current occupancy in transaction advisory while being witness to seeming irrationalities I have decided to conduct research to support my presumptions.

In the theoretical part of the paper we will, using relevant literature, define both of the terms of Human and Homo Oeconomicus and present theories which apply on each of the phenomena. Furthermore, we will analyze the sources of irrationalities and biases such as anchoring, herding bias, misperception of statistics resulting in gamblers fallacy and pattern seeking and look for analogies of them in the financial markets. Furthermore, we will present alternative theories of decision under risk as presented by Kahneman and Tversky (1979) and Thaler (1985).

In the practical part after defining the sources of irrationalities and behavioral theories of decision. We will assess experiment among groups of people involved in financial markets and those not involved with respectt to their propensity to bias of decision-making as well as questionaire in which we will observe decision-making aligned with the prospect theory.

The general hypothesis of the paper is “The people involved in the financial markets will show lower propensity to biasness of decisions in terms of presented theory”. Frankly we expect both of the groups to be showing propensity towards Human behavior, the experiment as well as the questionnaire are hence mainly aimed to reveal the difference among the groups.

1.Theoretical framework

1.1. Homo Oeconomicus vs. Human

The core of the mainstream economic theory lies in the phenomenon of Homo Oeconomicus - an agent of economy possessing an unlimited ability to decide rationally upon available information.

When looking in the origins of the concept of the Homo Oeconomicus it brings us to the very cradle of economics and the father of economics Adam Smith who wrote:" *It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own"* (Smith, 1776, p. 16) Despite the fact Smith hasn´t used the term neither has he exhausted the full definition, he presents a man as a creature pursuing his own interest through his action (in modern terms maximizing his utility) which is the main motivation and reason for the actions of Homo Oeconomicus.

The properties of Homo Oeconomicus (or alternatively economic man) are self-interest, consistent rationality, self-interest, and absolute self-control. We could alternatively view Homo Oeconomicus as a sort of robot lacking inclusion of any emotion what so ever in his decisions, immune to any deviation from his ultimate goal of maximizing utility. When "solving" the problem of maximizing utility he is able to comprehend any available information and consequently project them in his decisions. Assumption of Homo Oeconomicus is a base for countless economic models probably thanks to the simplification of world it offers. The main advantage of using the assumption is avoiding inclusion of biases in agent's behavior in economic models, which naturally gives the economist more graspable approach with agent being fully predictable on the other hand it is restricted tool in terms f mirroring reality

Herbert Simon defines Homo Oeconomicus as a man "*...who in the course of being "economic" is also rational. This man is assumed to have knowledge of the relevant aspects of his environment which, if not absolutely complete, is at least impressively clear and voluminous. He is assumed also to have well organized and stable system of preferences, and skill in computation that enables him to calculate, for alternative courses of action that are available to him…".* (Simon , 1955, p. 99). It is the second component of economic man -the rationality at which this thesis is mainly aiming. Rationality in perspective of an economist is an assumption, that every agent in economy

is making decisions which are logical, prudent and self-interested in order to maximize utility, profit or alternatively minimize disutility and losses, furthermore such a decision is then result of rational calculation among all available information.

1.1.1. Homo Oeconomicus and the Rational Expectations

Amidst the plethora of applications of the concept of rationality, for theoretical part of this thesis is especially handy the theory of Rational Expectations originally proposed by John F. Muth (1961), consequently broadened by Robert E. Lucas Jr (1972) and eventually becoming one of the cornerstones of New Classical Macroeconomics.

The motivation for the theory of rational expectations was to enable more realistic model of the market economy which would allow to intercorporate concepts of uncertainty and non-perfect information about all relevant aspects. In a vague terms the theory asserts that even if people might be wrong time to time when making decision about future on average they will be right in total. On top of that it assumes people use all the available information including economic theory as well as recent prices and past development.

The core idea of the theory of rational expectations is that there is no systematic difference in outcomes as compared to what is expected by the people. The revolution the theory brings, is that so far supra-rational Homo Oeconomicus individual could make mistakes but that should be aggregated among the economy and in total the expectations are correct and rational.

Shifting to the observed area of financial markets the theory of rational expectations, (as proposed by Muth (1961)) has been the cornerstone for efficient market hypothesis originally partly proposed by Fama (1965) in his The Behavior of Stock Markets. He claims that stock prices already internalize all the available information as investors (through their analysts) seek for the relevant information which they project in their BUY/SELL decisions. Consequently, it is impossible to outrun the market since the price reflects also all the predictable future influences. In a nutshell, the theory claims that the best predictor of firm's value in the future would be the stock price today. The concept once again justifies the phenomenon of Homo Oeconomicus and claims the markets are rational, where unpredictability is not a result of irrationality but rather external unforeseen shocks. (Fama, 1965)

Simple thought exercise upon the concept can get us to absurdities such as this one: Consider commodity market with agricultural product (e.g. citruses), prices of such commodities are heavily influenced by the weather forecast for obvious reason, agricultural products are very sensitive to weather and need the right ratio of rain and sunshine, hence having a "bad season" leads to a low yield of crops where scarcity of the crop should affect by the law of supply and demand price of the crop in a positive manner. However, applying the efficient market theory on such a case would mean that the best predictor of the weather is the price of citruses, even better than meteorological forecast.

1.1.2. Bounded rationality and Human

Aside from the theory of economics and an aid for more efficient modelling of decision-making in rational environment, just by observing world of everyday situations where the need for decision-making is omnipresent, makes one doubt the idea of Homo Oeconomicus and seek for alternative that shows somehow more realistic picture of the process a picture which is rather human.

The redefinition of the concept drew attention of economics academia among which Herbert A. Simon challenged the concept of rationality in his article Behavioral Model of Rational Choice. (Simon , A Behavioral Model of Rational Choice, 1955). "*Broadly stated, the task is to replace the global rationality of economic man with a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist"* (p. 99). He lays a foundation of an antithetical phenomenon to Homo Oeconomicus, which he calls an organism and in a limited sense is mirroring what Richard Thaler calls the Human. (Thaler & Sustein, 2008) The Organism is not robotic or computer like such as Homo Oeconomicus, it faces many obstacles to be that way. Organisms have cognitive limitations, are restricted by time, in which they make decisions, and ultimately influenced by the structure of the environment. Not to be mistaken bounded rationality doesn´t imply abandoning the concept of rationality entirely, in fact it doesn´t abandon it at all. Human same as Homo Oeconomicus is still in search for improving his well-being by the action of decision making. Rather than maximizing his utility by optimizing he does it by seeking for satisfaction while using available information and his bounded capability to analyze them

correctly, however in a sense he is doing his best, which doesn´t necessarily have to be perceived as rational from the perspective of an outside observer, thus it is perceivably rational from the point of the agent himself given the environment, limited capabilities and information he is "given".

Simon introduces a new term to fit in his theory and to substitute axiomatic term of optimizing to "satisfice". (Simon, 1956) "*Both from these scanty data and from an examination of the postulates of the economic models it appears probable that, however adaptive the behavior of organisms in learning and choice situations, this adaptiveness falls far short of the ideal of "maximizing" postulated in economic theory. Evidently, organisms adapt well enough to "satisfice"; they do not, in general, "optimize.""* (p. 129) The origin of the newly proposed term comes from two words to satisfy and to suffice their combination beautifully intercorporate the idea as such of a search for satisfaction while using sufficient means to do so. The means that the man uses consequently could also come in a form of heuristics, which will be given more attention further to the thesis.

To appreciate the change of the approach we must understand it's not only the approach it is the whole paradigm of economics that is being challenged.

1.1.3 The two systems of human mind

The functioning of the human brain is, despite the endless efforts, still to be explored in its full complexity. Whether observed from perspective of an economist, psychologist, psychiatrist, neurosurgeon or sociologist there is no field, that could proclaim with an easy conscience: We have answered all the questions we had about the human brain. Furthermore, presence of such a statement is objectively distant and there is a high chance of never being reached. However, thanks to excessive research in the field of human behavior, we are revealing its mystery by parts.

The origin of the perception of mind as two system functionalities, reaches beyond economics to the psychology where it was defined by Richard West and Keith Stanowich and is known as a Dual-Process Theory. (Stanovich & West, 2000). The core idea of Dual-Process Theory is division of the functionality of the human brain into two modes which combine each other in solving every-day or even more demanding tasks.

The System 1, according to West and Stanowich (2000) has properties of being associative, holistic, automatic, relatively undemanding of cognitive capacity, relatively fast, acquired by biology and based on personal experience. Meaning the tasks solved by the System 1 are in general highly contextualized, personalized, and vastly conversational and socialized, hence the type of intelligence used for solving such a task is interactional. In general, then it can be said that the System 1 is as formed by quick inflexible modules that operate intuitively.

On the other hand, there is the System 2, which works on the very contrary principles compared to System 1. It is an analytic, carefully controlled, relatively slower system acquired by cultural and formal tuition. The types of tasks solved by System 2 are in general decontextualized, depersonalized and asocial. Hence, the type of intelligence used for System 2 is analytical, which is somehow more graspable considering there are ways to measure such intelligence such as the standard IQ tests. (Stanovich & West, 2000)

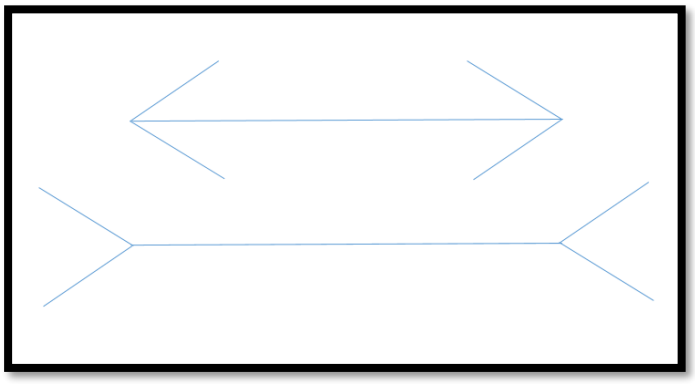
It is important to stress that the definition of Dual-process theory as proposed by psychology is not far from the definition proposed by behavioral economists, and are in a sense overlapping. For the purpose of this thesis, we will focus on the definitions proposed by Daniel Kahneman

Daniel Kahneman defines the systems in a following manner *'System 1 operates automatically and quickly with little or no effort and no sense of voluntary control.'* and *'System 2 allocates attention to the effortful mental activities that demand it, including complex computations. The operations of system 2 are often associated with the subjective experience of agency, choice and concentration.'* (Kahneman, Thinking Fast and Slow, 2011)

Having defined both the systems, now we will observe closely the functionality of the System 1, which is the base for developing the background of seeming irrationality of agents in the economy in general as well as the financial markets at which is the thesis aimed.

To demonstrate the power of system 1, lets show its functioning on a simple example of illusion in Figure 1.

Figure 1. Müller-Lyer illusion



Source: Muller, Lyer (1889)

The illusion, originally proposed by the German sociologist Franz Carl Müller Lyer, consists of set of two identical lines bounded by arrow heads facing opposite directions, and simple question: Which one of the lines is longer? The illusion itself lies within the fact that most of the people report the bottom line to be longer than the top line. There are many different psychological theories regarding the explanation of the phenomena, however it is not aim of this thesis to explain it in detail, rather we use it as an example of an illusion. (New World Encyclopedia contributions, 2014).

When you look at the Figure 1, your system 1 automatically draws an answer to the proposed question, i.e. the bottom line is longer. Such an answer doesn't cost any effort, and your brain accesses it immediately. However, the answer is wrong. Interestingly, if you were to measure the lines and prove to yourself that they are identical indeed (using the system 2), even knowing the answer doesn't convince the system 1 to give up and you will still perceive the lines having different lengths. Despite the fact, that optical illusion is not vastly applicable to economic theories or behavior in financial markets it gives us tangible concept to understand how cognitive illusions and biases are formed and the role of system 1 regarding the phenomena.

The system 1 is partly formed by evolutionary traits (e.g. identifying possible threat) or by internalizing some algorithms of thinking. The typical use of system 1 in a daily life could be: understanding a simple sentence, driving on an empty road, detect hostility in a voice etc. Indubitably, the system 1 differs among people depending on what actions do they internalize to automated regime, for example assume manager of a private equity fund with years of experience will by a quick glance at financial ratios, assess the state in which the company, he might be interested in, is in. On the contrary imagine a the same

assignment being faced by as student of finance he would need a deep and long thought of what the manager new right away. The skilled manager is using the system 1, but for the student the analysis is far beyond the reach of the automated system, hence he must use the system 2. (Kahneman, Thinking Fast and Slow, 2011)

The System 2 works in general as a complement to system 1, as stated by Kahneman: *"One of the main functions of System 2 is to monitor and control thoughts and actions "suggested" by System 1, allowing some to be expressed directly in behavior and suppressing or modifying others."* (Kahneman, Thinking Fast and Slow, 2011). The irreplaceable role of System 2 with respect to System 1 is programming the System 1, meaning situations already known and analyzed by the System 2 are consequently passed on System 1, gradually building holistic model of System 1as well as changing behavior model adopted by System 1 in events contradicting the already internalized reactions to an impulse. That is why the manager of the fund in the previous example could access the needed knowledge right away his system 1 is programmed by the years of experience in finance.

Essentially, unlike the System 1, which works all the time, System 2 needs sort of ignition to be employed. The ignition can arise from a change in situation, e.g. while the manager looking fast through the financial ratios (using the System 1), the situation suddenly changes when he sees suspiciously low indicator of returns on assets, and starts thinking what could be the cause (employing the system 2) and solves the situation with rather analytical approach. Another way of igniting the System 2 is right from the start of the problem solving, e.g. simple mathematical operations such as "2+2=?" will not demand the use of system 2 if the person is literate, however facing more complicated problem such as "73x26=?" will immediately ignite System 2. The ignition in this case is the brain immediately assessing the situation as not suitable for System 1 and launches the analytical system. Returning back to the manager of the fund, his analogy would be being presented balance sheets and profit and loss statements rather than the ratios, hence he immediately has to involve in rather complicated calculations.

If attempted to solve the second problem, it is in general common for the subject to feel immediate change in her state of mind and feelings. The System 2 requires substantial mental effort and concertation, hence the ignition of it imposes noticeable discomfort and it occupies clear majority of the brains capacity, which leads to another attribute of the System 2 – prevalence or in other terms extruding other brain activities, in order to solve the sudden situation. (Kahneman, Thinking Fast and Slow, 2011)

The question arises; Why are we taking the chance of misjudgment or false conclusion brought by System 1 and abandon its use for the ultimate dominance of System 2? In other words; Is it rational to take the chance of being irrational? The answer is straightforward, if we recall the example of rather complicated computational problem and the discomfort connected to solving the problem, it is clear, that maintaining high state of alert and effort of mind would lead to relatively quick exhaustion of one's mental capacity. Furthermore, if we take basic concepts of the both systems as proposed by Kahneman as a sort of axiom for drawing further conclusions such a question is nonsensical, since it's not up to one's decision whichever system is employed, it is rather a reaction to an external stimulus.

The connection of the system 1 and system 2 thinking in the context of Homo Oeconomicus and Human lies in the definitions of them. Homo Oeconomicus should not be subject to system 1 at all or only in cases where it doesn't jeopardize his rationality. On the other hand Human by its pure nature works on the concept of system 1 thinking, of course stating it is only the system 1 which he uses would be absolutely foolish, but unlike Homo Oeconomicus Human relies on the system 1 in situations where his analyzing capacity isn't sufficient or when his mind is tricked into a bias. In connection to the hypothesis of this thesis we expect Investors and agents in the financial market to prove to be more like Homo Oeconomicus, that is to be less vulnerable to biases than people outside of the financial markts, however still being their victim.

1.2. Behavioral biases

In the following section, we will define the common causes of deviating from rationality in financial markets as well as in general. Essentially, in this section we will be answering the question in the name of the thesis, i.e. What [could] deviate(s) investors from rationality.

1.2.1. Misperception of statistics

Statistical inference is an indispensable tool in economics as well as most of the academic fields incorporating statistics as a tool of research and most importantly (for this paper) it is a common tool to support decision-making in the financial markets and mergers and acquisitions. However, with all its usefulness statistics impose significant threat of being

misperceived, ergo causing the reader or even the researcher drawing biased or even opposite conclusions.

Kahneman and Tversky in their article "Belief in the law of small numbers" (Tversky & Kahneman, 1971) consider the general misconception of the law of large numbers, when applied on small samples. The study was performed as a questionnaire among researches in psychology with core hypothesis supposing their erroneous treatment of sample sizes during research and consequently wrong inference on statistical data often resulting in Type I. error.

The proposed hypothesis stated that people (in this case the researchs) believe in the high similarity among samples drawn from the population, and in the similarity to the population from which it is drawn.

The paper defines the believer of the law of the small numbers in a following manner:

1. *"He gambles his research hypotheses on small samples without realizing that the odds against him are unreasonably high. He overestimates the power.*
2. *He has undue confidence in early trends (e.g. the data of the first few subject) and in stability of observed patterns (e.g. the number and identity of significant results). He overestimates significance.*
3. *In evaluating replications, his or others', he has unreasonably high expectations about the replicability of significant results. He underestimates the breadth of confidence intervals.*
4. *He rarely attributes a deviation of results from expectations to sampling variability, because he finds a "casual explanation" for any discrepancy. Thus, he has little opportunity to recognize sampling variation in action. His belief in the law of large numbers, therefore, will forever remain intact."* (Tversky & Kahneman, Belief in the law of small numbers, 1971, p. 29)

The study revealed that majority of the researchers who participated fell in the category of law of the small numbers believers.

Despite the fact, this thesis is not aimed at the academic researchers in mathematical psychology the definition of the believer in the law of small numbers comes handy. The idea behind the amplified faith in small samples is in fact representation of more general illusion, i.e. "*we pay more attention to the content of messages than to information about their reliability and as a result, we end up with a view of the world around us that is simpler and more coherent than the data justify. Jumping to conclusions is a safer sport*

in the world of our imagination, than it is in reality." (Kahneman, Thinking Fast and Slow, 2011, p. 118) .

Connected behavioral trait to confidence in early trends is our tendency to seek for patterns. Using Kahneman's example (Kahneman, Thinking Fast and Slow, 2011), consider 3 sequences of 6 babies born at a hospital, the observed variable is the sex of the baby. The sequences are following:

BBBGGG

GGGGGG

BGBBGB

Are the above shown sequences subject to the same probability. The answer proposed by a System 1 in this case is "NO", however if the probability of boy being born is approximately equally likely to girl being born, then any sequence of a same length yields the same probability. The misperception of this fact has a root in the Human nature,*" We are pattern seekers, believers in a coherent world in which regularities appear not by accident but as a result of mechanical causality or of someone's attention. We do not expect to see regularity produced by a random process, and when we detect what appears to be rule, we quickly reject the idea that the process is truly random."* (Kahneman, Thinking Fast and Slow, 2011, p. 115)

Combining the random walk and the search for patterns rather than believing in randomness we can transfer the phenomena to the financial market where the misperception of statistics is at heart of the next bias resulting behavior the Gamblers fallacy.

Returning to the definition of the "law of the small numbers believer" there are two points which are crucial for explanation of common misperception of statistics and the resulting behavior, namely 2 and 4. The confidence in early trends and temptation to seek for causality results in erroneous inference of reality. The reason for that is partly ignoring the fact of true randomness of random events. Example of such a behavior is phenomenon of Gamblers Fallacy. *"The heart of the gambler's fallacy is a misconception of the fairness of laws of chance. The Gambler feels that the fairness of the coin entitles him to expect that any deviation in one direction will soon be cancelled by a corresponding deviation in the other. Even the fairest of coins, however given the limitations of its*

memory and moral sense, cannot be as fair as the gambler expects it to be.". (Tversky & Kahneman, 1971, p. 24).

The appearance of Gamblers Fallacy is present vastly in the financial markets. We will use an example from the environment of stock market The trader who is a subject to such a bias will expect sense of fairness regarding the trends in stock price, therefore when there is a decrease in the stock price investor suffering from Gambler's fallacy will expect the reverse movement, hence returning to the initial price of the stock. If taken in count only the preceding decrease, trader is therefore expecting self-correcting process to occur in events which are random.

On the other hand, this phenomenon can work vice versa considering the pattern seeking where the trader believes in continuous trend in the process that is mostly random. Hence, when the stock is growing he would gradually increase his long position. Essentially, such behavior is the major cause of bubbles as in the dotcom bubble, where investors believed in continuous growth believing in the past pattern of the price movement.

1.2.2. The Anchoring bias

Another example of deviating from rationality is defined by following:

"In situations, people make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased towards initial values. We call this phenomenon anchoring." (Tversky & Kahneman, 1974, p. 1128)

The absurdity of the functioning of anchoring was charmingly demonstrated by an experiment performed by Tversky and Kahneman on their students. The setting of the experiment was following: The students were presented a "wheel of fortune" with a range 0-100 that has been modified (loaded) so that spin can result in only 2 options, either 10 or 65. Consecutive to the spin students were asked completely irrelevant question, i.e. "Is the percentage of African countries in the UN higher or lower than the number resulting from the spin?", followed by, "Estimate the percentage of African countries in the UN.". The mean answers of the estimate among the groups were 25% and 45%, respectively to the groups presented 10 and 65. The results show the power of anchoring, where

completely irrelevant number, furthermore presented in a fashion stipulating its irrelevance, had significant effect on the answers. Including payoff for accuracy in the experiment didn't affect the results significantly. (Tversky & Kahneman, 1974)

Having defined the term of anchoring we may now look closer on its mechanics. Tversky and Kahneman had each different perspective on the way anchoring works, which can be connected to the principles of System 1 and System 2 mind setting.

The principle of anchoring as seen by Tversky is based on idea of an adjust-and-anchor heuristics. In this setting, anchor is used as a sort of tool, a deliberate mechanism to approach the answer. Essentially, the subject not knowing the direct answer to the question retrieves an anchor from his memory and adjusts along the expected direction using anchor as a starting point. Obvious example of such an use of anchoring can be any question aiming at a point in an ordinal sequence of numbers (years, height etc.), e.g. "When did George Washington became president?". Of course, someone with deeper knowledge of US history would respond with a precise date, however not knowing exactly the answer the anchor can be 1776 (because he clearly hadn't been president before the Declaration of Independence was signed) from which by adding years we are moving towards/adjusting to the actual answer. How does the principle fall in the category of heuristics and biases?- The answer is insufficient adjustment. Insufficient adjustment is phenomenon of failing to adjust the anchor enough to the coveted result. Example of the aforementioned phenomenon is following situation: While pulling in a city road from highway driver decreases his speed, where the speed on the highway serves as an anchor, however the driver is in the middle of conversation with the passenger next to him, hence his System 2 is employed in other activity (depleted), consequently insufficiently adjusting his speed resulting in speeding in the city. "*People adjust less when their mental resources are depleted, either because their memory is loaded with numbers or because they are slightly drunk. Insufficient adjustment is failure of a weak or lazy System 2."* (Kahneman, Thinking Fast and Slow, 2011)

The problem with Tversky's interpretation of anchoring is that it is built on the principles of System 2, deliberate use of anchor based on subjective experience or knowledge. However, such an approach fails to incorporate cases similar to the example of the "wheel of fortune". It is nonsensical to assume the students deliberately assumed the randomly assigned (in their perception) number as a meaningful anchor for their answer. Hence Kahneman proposes different approach to the phenomenon – Anchoring as priming effect. The principles anchoring as a priming effect are showing closer ties to the System

1 when assessing the information. *"System 1 understands sentences by trying to make them true, and the selective activation of compatible thoughts produces a family of systematic errors that make us gullible and prone to believe too strongly whatever we believe"* (Kahneman, 2011, p. 122)

Unlike many of the behavioral phenomena, anchoring effect can be measured, hence is conveniently comparable among group of subjects. Which we intend to use for testing the proclivity to biases among groups of people involved in the financial markets and those not involved in the practical part of the paper. The tool to do so is the anchoring index. Which we intend to use for testing the proclivity to biases among groups of people involved in the financial markets and those not involved in the practical part of the paper. The computation is following:

$AI := anchoring\ index$
$A_h := \ high\ anchor$
$A_l := low\ anchor$
$E_l := estimate\ (response)\ with\ respect\ to\ low\ anchor$
$E_h := estimate\ (response) with\ respect\ to\ high\ anchor$

$$(1)\ AI = \frac{E_h - E_l}{A_h - A_l}$$

$AI \epsilon (0; 1)$

Anchoring index is usually reported in a percentage form meaning: If $AI = 0\%$ then $E_h - E_l = 0$, hence anchoring has no effect on the responses (estimates); If $AI = 100\%$ then $E_h - E_l = A_h - A_l$, hence anchoring has full effect on responses (estimates), since they are equal to anchors. (Kahneman, Thinking Fast and Slow, 2011)
To demonstrate the use of the anchoring index, let's use an experiment performed by researchers of the University of Arizona on real estate agents. (Northcraft & Neale, 1987). The aim of the study was to observe responsiveness of subjects between the two groups to anchoring. The subjects in the study where expert real estate agents (expert subjects) and business students (amateur subjects) who were presented set of information, one of which was the listing price (the anchor), about the house and were let to inspect the house to assess the appraisal value of the house. The anchors were $65,900 and $83,900. The expert subjects reported in only 14.9% cases to include the listed price among other

variables when assessing the value of the house. The reported appraisal values were 67,811 and 75,190 respectively to the low anchor and high anchor. Therefore, the anchor index for Expert subjects is following:

$$(2)\ AI = \frac{75{,}190 - 67{,}811}{83{,}900 - 65{,}900} * 100\% = 40.9\%$$

The conclusion is hence that despite reporting of not taking the listed price in count during the appraisal, the experts were mistaken and took the listed price in count indeed, however in the form of anchoring. Interesting, was the nescience of the participants especially in the group of experts who claimed there is no chance some anchor could have biased their decisiom. (Northcraft & Neale, 1987)

In the financial markets such phenomenon can be seen especially in the transaction process in mergers and acquisitions where part of the whole process is step called indicative bid proposal where buyers offer a bid of the price to the seller. Despite the indicative bid is not binding the buyer stores the bid in his mind essentially still thinking of it when settling the final price and moving along as an adjusting anchor.

1.2.3. Herding bias

The idea of herding is based on the phenomenon of imitation or social influence, where individual or a group influence other/s. Essentially, herding bias is very common Unlike previously mentioned cases of biasedness, herding itself doesn't have to necessarily be viewed as strictly irrational, furthermore it can be a result of one's coherent calculus. *"An individual´s thoughts, feelings and actions can be influenced by other individuals by several means: by words, by observation of actions (e.g., observation of quantities such as supplies and demands), and by observation of the consequences of actions (such as individual payoffs, or market prices). This influence may involve fully rational learning, a quasi-rational process, or even an updating process that does not improve the observer´s decision at all*." (Hirshleifer & Teoh, 2003, p. 27) The above-mentioned phenomena can result in either behavioral convergence (increasing behavioral similarity) or even divergence (increasing behavioral dissimilarity), in which case we refer to it as dispersing as opposite to herding. The possible sources incentivizing herding/dispersing behavior could be following:

a) Payoff externalities

-are arising from increasing social utility from herding behavior. The example of such an incentive can be financial markets at its core which movements are purely dependent on the group behavior.

b) Sanctions upon deviants

-are incentivizing the herding from the opposite side, therefore to exclude oneself from the herd will result in a form of penalty or punishment in general. The example of such an incentive could be found again it the financial markets where not exiting position why the rest of the market is could result in tremendous losses.

c) Preference interactions

-are incentive for both herding and dispersing solely on the base of preference of inclusion or exclusion of the group. Simple example are fashion trends where one can be influenced to part-take on the herd behavior and purchase certain fashionable items to be part of the herd. On contrary, there will be individuals whose reaction would be completely opposite, therefore not purchasing the fashionable items solely to reveal their preference of non-part on the herd behavior.

d) Direct communication

-is an incentive stating directly the preferred action. In direct communication, the influenced agent is directly approached and for example influenced by statement "Option A is superior to B". The result of such an incentive is strongly dependent on the credibility of proposing agent or group. Example in finance is receiving a call from broker recommending to invest in certain stock exchange title.

e) Observational influence

-is based on observing actions of others agents or/and their consequences and consequently applying them on own actions. (Hirshleifer & Teoh, 2003).

Obvious example of observational influence is phenomenon called copycat investing, where funds or individual investors either copy the strategies of others or even build very similar or identical portfolios. Very common subject copycatting is the CEO of Berkshire Hathaway Warren Buffet whose strategies are often presented in media and serve as a benchmark for many funds and individual investors. (Caldwell, 2016)

Hirshleifer and Teoh (Hirshleifer & Teoh, 2003) define taxonomy of different sources of behavioral convergence or divergence in a form of double hierarchy formed by observational hierarchy and payoff interaction hierarchy, the two approaches are not

mutually exclusive. The Figure 2. shows the alignment of the "sets and subsets" of both hierarchies.

In his study, Ivo Welsh (2000) has aimed at revealing herding among security analysts on New York Stock Exchange. The study was conducted on the data of recommendation of top 20 NYSE brokerage firms, in terms of number of recommendations, which covered about 50% of total amount of "Buy, Sell" recommendations. Welsh has found sufficient statistical evidence proving his hypothesis of recommendation revision of one analyst has a positive influence on the next two analysts' revisions. Hence, the phenomenon of herding is indeed present in the financial markets. (Welsh, 2000)

1.3. The Prospect Theory

The core of the motivation for Kahneman and Tversky (1979) to revisit the concepts of decision making was an observation, which they refer to as Bernoulli's errors.

To even attempt to point in a direction of errors of Daniel Bernoulli member of a prominent family of mathematicians and one of the greatest mathematician of a 18th century himself we should first comprehend what are we suggesting to be erroneous. Amidst the countless fields Bernoulli excelled in, for our purpose we are mainly interested in his contribution in observance of desirability of money. (The Editors Of Encyclopedia Britannica, 1998)

When we talk about desirability of money we are assuming something we would call utility today. What precisely Bernoulli observed was the relationship between the utility changes related to the amount of money,in particular, he proposed a new theory regarding evaluation of gambles. The mathematicians of Bernoulli's time as well as their predecessors had assumed that gambles are approached through theory of expected value. Expected value is a straight forward approach in which the expected value of a gamble is a sum product of possible outcomes of a gamble and their assigned probabilities. Mathematically:

(3) $E(X) = p_1x_1 + p_2x_2 + \cdots + p_nx_n$

$Where$:

$$n \in N$$

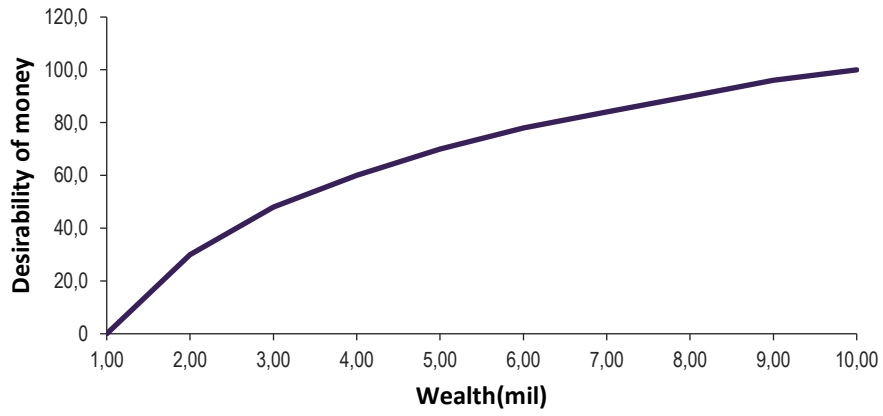
$x_2 \ldots . x_n$ are the payoffs arising from the possible outcomes of the gamble

$p_1 \ldots . p_n$ are probabilities assigned corespondly

Bernoulli observed that the approach proposed by mathematicians does not correspond to the reality because expected value of the gamble wouldn't be taken be the gambler the same as the same amount in sure value, (in other words he found an evidence of risk-aversion) and offered different view- The decision in gamble is not powered by the value of the money (in corresponding units), hence the utility corresponds rather with the psychological value of the gamble.

Bernoulli (1738) calculated what we would call utility function shown in the graph below:

Graph 1. Bernoulli´s Utility Function



By a quick glance at the graph of the close to logarithmic function we can see that Bernoulli, even though unwittingly, and definetely never used the term) layed a base for what is the core of economics: phenomenon of the „Law of diminishing marginal utility", but for Bernoulli's purpose, he discovered what is conceptually expected utility. Which we can represent mathematically by the following equation:

$(4)\ E(U) = p_1u_1 + p_2u_2 + \cdots + p_nu_n$

$Where$:

$n \in N$

$u_1 \ldots . u_n$ are the values of utility arising from the outcomes which vector is denoted U

$p_1 \ldots . p_n$ Are probabilities assigned correspondingly

The revolutionary idea there is the use of logarithmic function which shows utility values representing the relative changes in wealth rather than nominal change as it was in case of expected value.

Finally, after introducing the essence of Bernoulli's contribution to the decision-making under risk let us return back to the intial topic. Despite the magnificence of Bernoulli's work, there seems to be serious flaw in its setting, which Tversky and Kahneman (1979) call Bernoulli's errors. Amusingly, Kahneman (2011) explains how academia had been using expected utility as a tool almost an axiom and no one has given a though of revisiting the theory, which itself is a sort of bias of theory induced blindness.

Let us use simple example borrowed from Kahneman´s Thinking Fast and Slow (2011). Assume following:

At a time t subjects A and B both have a wealth of 5 million, according to Bernoulli's theory they should both experience the same utility. However, consider at a time t-1 A had 1 million and B had 9 million of wealth.

It is apparent that A and B are probably not feeling the same about their wealth since A has just gained 4 million where B had experienced loss of 4, hence their utility shouldn´t be the same either. Consequently, it seems logical that their utility in this particular case, is influenced by the recent change wealth rather than a utility derived from the state of wealth at the time t. Hence, what the original theory misses is a reference point. (1979)

Another case of flaw of the theory is following:

A's current wealth is 1 million and B's current wealth is 4 million. Both A and B are offered 2 options either a gamble or a sure thing: The Gamble has a following properties end up owning 1 million or 4 million both with .5 probability and the sure thing is owning 2 million. The expected wealth is 2.5 million when choosing the gamble and 2 for the sure thing. Hence in a Bernoulli's perspective they are both facing the same outcomes. However, the perspective A and B would be looking at the options is quite contrasting.

A: Either double her wealth (in a sure thing) or take a chance of gamble to quadruple the wealth or remain the same with .5 chance.

B:Either loose half of her wealth (in a sure thing) or take a chance to loose ¾ of her wealth or not loosing anything.

Once again it is obvious by the narrative of their options that A and B are not facing the same decision problem. (Kahneman, 2011) .

This observed inconsistency has motivated Tversky and Kahneman to revisit the Bernoulli's theory from a new perspective, which gave birth to the Prospect Theory (Kahneman & Tversky, 1979).

To even attempt to present their critique we need to define a prospect and Expected utility theory : "*A prospect* $(x_1; p_1; \dots; x_n; p_n)$ *is a contract that yields outcome* x_i *with a probability* p_i *where* $p_1 + p_2 + \cdots + p_n = 1$*"* (p. 263), (simplified for 2 options of either payoff x with probability of p or 0 p-1…(x,p;0,1-p)) The expected utility stands on a three major tenents:

Expectation: $U(x_1; p_1; \dots; x_n; p_n) = u(x_1)p_1 + \cdots u(x_n)p_n$

i.e. Overall utility of a prospect

Asset integration: $(x_1; p_1; \dots; x_n p_n)$ is acceptable at asset position w iff $U(w + x_1; p_1; \dots; w + x_n; p_n) > u(w)$

(not in all cases but vastly used) Risk Aversion

u is concave

(pp. 263-264)

To challenge the theory Kahneman and Tversky (1979) performed series of experiments in search for phenomena violating the definition of Expected utility theory for which they used method of hypothetical choices rather than experiments with real payoffs for which they claim sufficiency on the assumption that people are aware of their reaction in presented situation and aren't motivated to disguise their true preferences. It is sufficient to show their methods, since we will use them in assessment of human behavior among the groups of people involved in the financial markets and those not involved. Their critique will be presented in sections with experiments aiming at individual phenomena. This first section of the critique aims to show that people give a greater weight to outcomes that they consider certain as compared to those that are merely possible called "the certainty effect" (Kahneman & Tversky, 1979, p. 265) . The experiments were aiming at disproving the substitution axiom of expected utility theory. The experiment performed to reveal that was following, there were two consecutive problems presented to the 95 subject of the experiment:

Problem 1 :
A: (4000,.8) – preferred by 20% or B:(3000) – preferred by 80%
Problem 2.
C:(4000,.20) -preferred by 65% or D: (3000;.25) – preferred by 35%

With a closer look at the problems the only difference is that both of the probabilities assigned in the Problem 1 have been multiplied by .25., hence the preference order shouldn't differ according to the Expected Utility Theory, however it did, furthermore it did significantly. Consequently, it shows that effect of decrease of probability of an outcome form 1 to .25 is greater than effect of an increase from .8 to 2., thus violating the axiom.
More important violation of the axiom, that has later served when building the prospect theory has arisen from following experiment with 66 subjects:

Problem 3:
A: (6000,.45) - preferred by 14% B:(3000,.90) -preferred by 86%
Problem 4:
C: (6000,.001) – preferred by 73% D: (3000,.002) – preferred by 27 %

The major difference in between the two problems is, in the first case quite probable outcomes turn into merely possible. Despite the fact it is again violation of the substitution axiom of expected utility theory, the outcome gives space for inference of a rule:
If two prospects m & n are equivalent in a preference scheme but m has a lower assigned probability then multiplying both probabilities by a coefficient between 0 and 1, will consequently make m preferred over n. (Kahneman & Tversky, 1979)

Like the previous section Kahneman & Tversky (1979) performed series of experiments this time, however aimed at the losses, the chosen approach was simply running the same experiments where gains are substituted by losses. The aim of the experiments proof existence of the "reflection effect"-"*reflection effect implies that risk aversion in the positive domain is accompanied by risk seeking in the negative domain*".The results were astonishing, all of the performed experiments had exact mirror image of results as compared to the case with gain scenario. The conclusion is "*In the positive domain the certainty effect contributes to a risk averse preference for a sure gain over a large gain*

that is merely probable. In the negative domain the same effect leads to a risk seeking preference for loss that is merely probable over a smaller loss that is certain" (pp. 269-270)

Tversky and Kahneman (1979) claim that when facing a choice between compound alternatives people focus on distinguishing components rather than the unifying ones in a consequence it could lead to inconsistent preferences- they label such phenomenon "The isolation effect".

To reveal the isolation effect there had been multiple experiments conducted by the two scholars. However, one is especially interesting in accordance to observing hereinabove mentioned phenomenon. In the first round of the experiment, 70 subjects (in the hypothetical setting) are informed to be given 1000 in addition to their wealth. In the next step they decide between following prospects.

Problem 5.

A: (1000,.5)- preferred by 16% or B (500)- preferred by 84%

In the second round of the experiment the bonus raises to 2000 and the offered prospects are following:

Problem 6.

C: (-1000,.5)- preferred by 69% D: (-500)- preferred by 31%

Before jumping to conclusion it is crucial to realize that the both scenarios, including the bonus offer identical final asset positions, nevertheless the prospect preferred by subjects changes. This is a case of isolation effect because the bonus was apparently ignored by the subjects in assessing the choice hence caused the subjects to be blinded by their negligence. This conclusion points to the direction that the utility is assessed by changes of wealth rather than by the final asset position, which is in contradiction with the expected utility theory, and as such had become the cornerstone of the Prospect theory. (Kahneman & Tversky, 1979)

1.3.1. The Editing

The prospect theory of decision-making under risk divides the process of decision-making into 2 major phases of editing and evaluation. In simple terms the phase of editing serves for the agent as a stratification of the problem and setting a base for the actual decision based on the evaluation.

The sequence of the components of the editing phase as stated hereunder doesn't introduce an order among them during the decision process. We will start with the component of coding.

Coding, is a process in which the agent identifies the setting, meaning he identifies whether he is facing prospects of gains or losses and realizes his reference point which conforms to his current asset position.

This phase seems to be a real challenge to rational thinking in terms of system 1 and 2 and proclivity to biases. When applied on an investor, she must employ extensive amount of system 2 thinking in order to stay rational and preventing biases arising from the expectations of a deal or even other deals which could technically project in her assessment of current asset position and furthermore shield herself not to be subject of deliberate framing of the counterparty.

Combination is a process of simplification of the problem through calculation of compound probability if the outcomes of the prospects are identical. In general, the phase of coding doesn't induce threat of misperceiving the problem it quite simple mathematical process.

Segregation applies in the cases where there is a presence of a riskless component in the problem. Such component is then extracted. Once again this process has quite low proclivity to biases. In spite of employing majorly the system 2 thinking, it is quite simple process that only requires mathematical computation, and probably due to obvious employment of system 2 doesn't impose threat to misperception of the problem.

Cancelation is process of isolating components that are identical among the prospects. We have already focused on this process during the critique of Expected Utility Theory, the problem 6 hereinabove is the case. The subjects through the process of cancelation isolated the common trait of the prospects which was the bonus, and consequently shown

in the second round of the experiment deviation from rationality through treating the prospects with equal final asset position differently.

Summing up the editing phase there are other two components- simplification and detection of dominance. Simplification consists mainly of rounding and overall mathematical adjustments to simplify the problem, however important component of simplification is discarding outcomes which are extremely unlikely. Detection of dominance as in game theory asserts exclusion of dominated prospects. (Kahneman & Tversky, Prospect Theory: An Analysis of Decision under Risk, 1979)

Altogether editing phase is fragile when it comes to resisting attempt to fast thinking. Moreover, the importance of correct assessment of editing phase is tremendous, because it sets the subjectively perceived rules of the game. If we form it in parallel editing phase is the lobby of the decision making it is the time before decision where, as in the lobby, you wait and think through what is your position before the meeting/decision.

1.3.2. The valuation

After the problem is edited the agent progresses to the decision *per se*, by valuation of all edited prospects and choosing according to the highest value. Kahneman and Tversky (1979) introduced a new equation for the valuation of the prospects which we show hereunder:

(5) $V(x,p;y,q) = \pi(p)v(x) + \pi(q)v(y)$

Where:

V… is the overall value of the prospect

x,y… are possible outcomes of the prospect

p,q… are assigned probabilities of each of the outcomes

v… is a subjective value of the outcome (utility)

π… reflects the impact of p or q on the overall value of the prospect

The key to the major difference to the previous theories lies within the weighting function ($\pi(p)$), which allows incorporation of decision weight, and (v(x)) which allows for subjectivity in valuing outcome.

"*An essential feature of the presented theory is that the carriers of the value are changes in wealth or welfare, rather than final states*" (Kahneman & Tversky, 1979, p. 275)
The idea here is that wealth and the final state of assets ar quite subjective. Consider an investor running a portfolio worth 40 million US dollars and due to combination of bad luck and choices he manages to lose most of the value of the portfolio within the year and ends up with the value of 1 million. Needless to say, such an investor is experiencing enormous disutility on the other hand consider investor who starts his investing with 100 thousand US dollars and within a year he manages to increase his value ten times to 1 million. It is obvious that both of the investors differ dramatically in perceiving their current asset position.
Hence the value function incorporates two arguments one the reference point (asset position) and the magnitude of the change.

The hypothesis of Kahneman and Tversky is that the function has a convex shape for losses and concave shape for gains, in other words subjects are risk averse in gains and risk seeking I losses. Following experiment of choice among prospects gives justification of this hypothesis.
Problem 7:
A: (6000,.25) -preferred by 18% B: (4000,.25;2000,.25)- preferred by 82%
Problem 8:
C: (-6000, .25) – preferred by 70% D: (4000,.25;2000,.25) preferred by 30%

Applying the results in the proposed model and already leaving out the weight of the decision since the assigned probabilities are equal we get:
(6) $v(6000) < v(4000) + v(2000)$ & $v(-6000) > v(-4000) + v(-2000)$

The results for the gaining prospects is a definition of concave function as for the losses we are looking at the definition of convex function- which corresponds with the hypothesis.
Kahneman and Tversky (1979) claim there needs to be room left for special circumstances and effects which could in result reveal convex regions for gains and concave regions for loses. This appears to be very true for the investors too. Such an effect could be for example bounded bz an restriction in the losses region at which he would have to sell

parts of his portfolio around such critical value the value function may show dramatic decrease becoming concave around the region.

To conclude the shape of the Value function we need to reveal one more attribute of steepness relative to the magnitude of the change.

Kahneman and Tversky (1979) observed that when facing symmetric fair bets (win/loose identical amount with a .5 chance) people find them generally unattractive furthermore the aversiveness increases when facing bets with higher stakes. Hence the losses bring higher disutility than equal gains bring utility which points in the direction that the function is steeper on its negative domain. (Kahneman & Tversky, 1979)

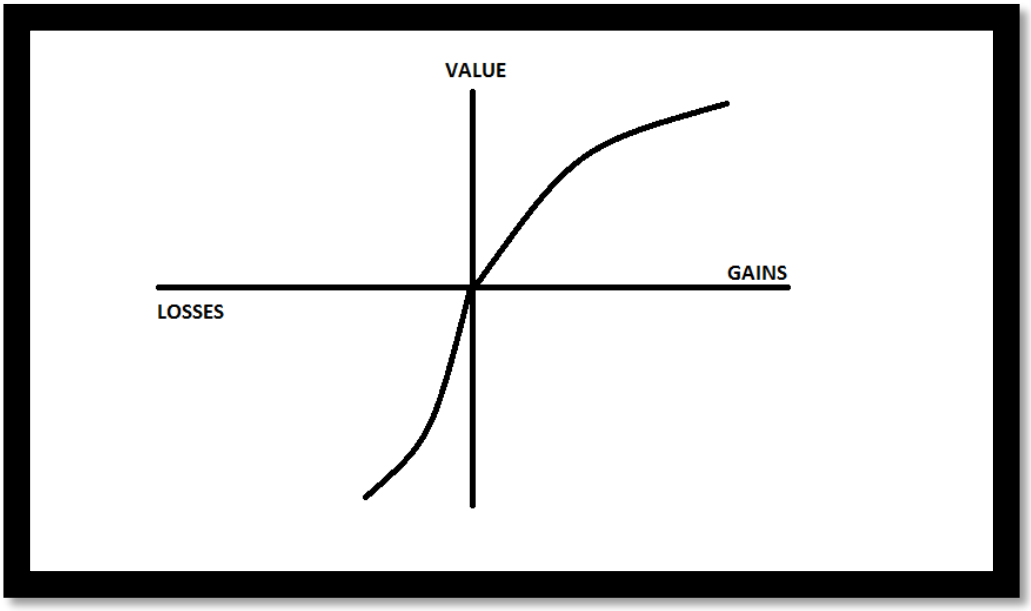
Summing up the value function of the prospect theory has following properties

I .Defined on the deviations from the reference point

II .Concave for gains and convex for losses

III . Steeper for losses than for gains

Figure 2. The Value function



Source: Kahneman and Tversky (1979)

The last component which we haven't mentioned is the weighting function.

The weighting functions regards the subjective treatment of the stated probabilities or as stated hereinabove the decision weight (denoted $\pi(p)$ in the function). The basic idea of

incorporating weight into the theory is people's misperception of probabilities especially in extreme cases (close to 0 or 1)

When subjects face a choice between sure payoff of very low amount against high payoff with extremely low probability the tend to choose the high payoff even if their expected values are the same, the reason for that is phenomenon of overweighting, typical example of that is act of buying lottery ticket. Alternatively, the choices work vice versa in losses (i.e. insurance).

If turned to the other extreme subjects tend to underweight almost sure probabilities.

In addition to that in a real world setting where probabilities are not stated agents in decision making tend to underestimate events with high probabilities and overestimate events with low probabilities which consequently projects into the weighting function which in a real world would have both phenomena influencing it.

In the financial world overestimating and underestimating shouldn't be the case because of the present analytic apparatus, however when it comes to pure decision making the Investor is facing similar problem as the one in aforementioned experiments, where the probabilities are stated but he might underweight or overweight their impact. (Kahneman & Tversky, 1979)

As stated before the reference point is a crucial determinant of one's decision. Hence, shifts in the reference point might result in different choices of the decision maker. Crucial influence on the shifts in the reference point might be not adapting to the recent changes. Assume an investor who has recently faced a loss of 2000 and is facing a choice of either getting 1000 for sure or a fair gamble for 2000, if he hasn't adapted to the recent change he might view the problem as a very opposite adding the loss of 2000 during coding phase.

Other case can be counting other expected incomes into current reference point. This phenomenon could by vastly present in the financial markets as during many progressing deals investors could perceive some as a sure income or loss and projecting them in their reference points, thus letting it bias their decision on another deal. (Kahneman & Tversky, 1979)

1.4. Mental accounting and consumer choice

The theory of mental accounting as proposed by Richard H. Thaler (1985) is essentially a revolution made on the basis of Prospect Theory (1979) into the theory of consumer choice ultimately developing new concept called Transaction Utility.

The major change within the theory arises from replacement of the utility function presented by the economic theory by a new value function covered in the previous chapter. Thaler (1985) stresses the importance of the coding component in the editing phase where the agents' code differently joint outcomes- (x,y) . The options for coding are either segregation where outcomes are valued separately v(x)+v(y) or integration where outcomes are valued jointly v(x,y). With respect to the Prospect Theory there are generally four combinations to consider when valuing joint outcome which reveal the agents preferences.

a) Multiple gains - given properties of the new value function on the positive domain – the concavity v(x)+v(y)> v(x+y) -> the segregation is preferred
b) Multiple losses – given properties on the negative domain – the convexity v(-x)+v(-y)< v(-(x+y)) -> the integration is preffered
c) Mixed gains – combination of outcomes (x,-y) given x>y -> v(x)+v(-y)< v(x-y) hence the integration is preferred. This case is not as obvious as the previous cases and requires a bit of mathematical thought on behalf of properties of the value function. The value function is steeper on its negative domain so theoretically v(x)+v(-y)<0 is possible. We can generally state $abs\big(v(x)\big) < abs\big(v(y)\big)$ which provides the answer.
d) Mixed loss- combination of outcomes (x,-y) given x<y is by far the most interesting case and as such isn't straight forward. The results depend vastly on the values of x and y. With a large loss (y) and relatively small gain (x) we are looking at flat region of the value function in negative domain with losses and rather steep region in the gain section, hence the segregation dominates. Thaler (Thaler R. , 1985) refers to this phenomenon as a "silver lining". Given both x and y being relatively small integration would be preferred.

1.4.1. Transaction Utility

In a pursuit of incorporating psychological aspects of buying into choice model Thaler (1985) divides utility into two components or stages. Acquisition utility arises from agent's valuation, hence depends solely on the subjective value received, in a manner introduced in the previous section. Rather new phenomenon in the theory is so called Transaction utility which depends on a fairness of a deal.

To show on an example consider following situation: As an investor you have spotted an acquisition opportunity, let's assume among other investors you have spotted the situation rather late but still get involved in negotiations and after the whole transaction process you actually get to acquire the company. You have acquired the company for a price your advisors found as fair given the sectors common EBITDA multiple and the adjustments to the EBITDA resulting from the financial due diligence they performed, so your Acquisition utility you get from the deal since is where you bought it, it fits your preferences, and you are generally happy. However later you find out from the street talks that when you were joining the negotiations other investor had his offer on the table and the deal was almost struck for way lower price with him. At this point the transaction utility gets involved in a negative terms and your "happiness" gets lowered by vast because you don't see the deal as fair anymore.

To show such function formally we need to define the variables:

z… the good

p… price charged for the good z

$\bar{p}$… value equivalent of the good z (receiving z or $\bar{p}$ as a gift should leave the agent indifferent)

p^*… reference price for z (or a "just" price for z)

Given those variables we can proceed to building the model. As stated hereinabove the model will consist of transaction utility and acquisition utility which form together the overall utility from transaction.

The acquisition utility is then defined as a compound outcome $v(\bar{p}; -p)$ and will be in most cases coded as integrated outcome.

The transaction utility is then dependent upon relation of the price the agent is paying p and some reference price p^* $v(-p;-p^*)$. Then the overall utility w is defined as a sum of both utilities, the overall utility is a function of p^*, p and z.
Formally:
(6) $w(z,p,p^*) = v(\bar{p};-p) + v(-p;-p^*)$

Looking at the formal definition of a function we can see that our investor from the example was originally right at point where the deal made sense for him, he didn't have the reference price to project on. However, after finding out he is experiencing disutility arising negative sign of $v(-p;-p^*)$, even though the deal is still profitable in terms of future value of the firm which determined the $v(\bar{p};-p)$. Transferring to simple terms he now knows he didn't get a "just" price and could have potentially save some of his money given the hypothetical situation he would know the reference price ahead. Frankly, given that he would know ahead there is a large probability that he wouldn't get the deal which could even prevent him from the future incomes arising from the firm. (Thaler R. , 1985)
Having defined the utility function in the next step is proceeding to the purchase decisions. In a common economic theory second determinant of the purchase aside from the utility function would be the budget constraint which usually refers to overall budget incorporated into the utility function and optimized (in a common problem trough Lagrange's multiplicators or other suitable method). Thaler (1985)
goes further in his theory and introduces rather new concept to the whole phenomenon.
Formally the decision decision process can be modelled by saying the consumer will buy good z at the price p if:
(7) $\frac{w(z,p,p^*)}{p} > k_{it}$

Where the k has a similar role as a Lagrange multiplier in the standard optimizing problem, however the k has a broader role in conection to human behavior. The t index of k is an intertemporal determination of budget constraint. to put it in a perspective consider a manager of a merger and acquisition department a big corporation. Such a manager is constraint temporarily by the decisions of the board regarding his annual budget for acquisitions he would then not only be constrained by the full budget when deciding about acquisitions, but as well by the budget designated for the particular year.

The i index of k determines the category. This is based on Thaler's (2008) assumption that people dedicate their budget to special purposes which they treat differently. Again to put it in a perspective consider a manager of a private equity fund. (Thaler R. , 1985) Such a manager can be restrained by the categories to which he invests. The category can be derived upon many factors but for this purpose consider it is the industry. The manager might set a rules for his fund to keep some share in for an example energy industry, different share for food processing industry and hence will start treating them as categories rather than looking at the whole volume of the fund.

2.Practical Part

2.1. Anchoring experiment

The idea of the following experiment is to use measurable assessment of decision bias on distinction of group of people in financial markets and group of subjects not involved in them.

2.1.1. Aim of the experiment

This experiment is based on an experiment proposed by Tversky and Kahneman (1974). The original experiment has aimed to reveal the existence of anchoring and was performed on the group of students.

The aim of this experiment is to reveal, whether Investors as well as people working in the field of mergers and acquisitions as advisors show lower proclivity to be subject of Anchoring as compared to people working in other fields and students. It is based on an assumption, that people working in the financial markets and M&A should be closer in their behavior to the concepts of Homo Oeconomicus rather than Human, hence their proclivity to be a victim of a perception bias should be generally lower. Therefore, the experiment is challenging their connection and usage of the system 1 and 2 thinking, in other words revealing dominating usage of system 2 points indirectly towards being Homo Oeconomicus and vice versa.

Hence the hypothesis is following: Subjects involved in the financial markets are behaving more in accordance to the concept of Homo Oeconomicus as compared to subjects not involved in financial markets.

2.1.2. Subjects

The subjects in the experiment were divided into two groups, according to their occupation or alternatively active presence in the financial markets as their secondary income activity. For the purpose of the further text, we will call the group connected to financial markets the FINs and the other group nonFINs.

Within the FINs the subjects varied in the form of involvement in the financial markets. Among the subjects there were two chief financial officers, where the justification for being treated as a FIN is mostly involvement in the foreign exchange market in form of hedging currency fluctuations as well as common use of variety of financial securities such as bonds. Next three subjects were not involved in the traditional financial markets but were included as FINs due to their trading activities in crypto-currency markets trading mostly Bitcoin, Etherum, Dashcoin and Litecoin. All three subjects were trading as a form of secondary income while maintaining their "day-job", however one of the subjects' income from trading cryptocurrencies was largely exceeding his "day-job" income. Group of 6 was formed by transaction advisors i.e. advisors in the mergers & acquisitions field, who are in contact with investors and in fact providing rational and factual background for the investors' decisions. And the last 3 were FOREX traders who similar as the crypto-currency traders involve in financial markets as a form of secondary income. Altogether the FINs formed group of 14, among which the experiment was performed.

The only requirement for the participation in the nonFIN was non-involvement in financial markets, hence the nonFINs were easily accessible for the participation. The group was diversified among many occupations from managing director of a Swedish company with activities in mechanical industry to accountants an designers. Altogether the group consisted of 14 precisely to match the group of FINs.

2.1.3. The treatment

The experiment consists of two part.

a. The first part aims whether the subjects react to a fully random anchor. That's where we need to use slight deception. In this case the deception is justified, since we are performing only one round, the threat imposed by deception in experiments is hence irrelevant and the deception cannot bias the results per se.

   We cannot allow the anchors to be fully random, furthermore we don't in fact need it, we only need the subjects to believe the number they see is random. The reason for the perceived randomness is that we need the subject to understand the anchor does not have any meaningful tie to the rest of the experiment- the following question. We need the anchor(s) to be 2 numbers, specifically one number as a low anchor and the other as a high anchor, the reason for this restriction is the method of assessment of the results. The approach of securing perceived randomness through the subjects drawing a number written on a paper from a hat with a dozen of pieces of paper. The trick lies in the options the subjects have for drawing. There were either low anchor numbers or high anchor numbers in a hat, which fulfils both of our criteria (i.e. perceived randomness as well as high/low anchor)

   In the experiment the subjects were approached individually and distributed the experiment sheet. (enclosed in the appendix of the thesis as Experiment 1).

   The steps were following:

   1. In the first step subjects were asked to draw "random" number from the hat.
   2. In the second step subjects were asked to read the number out loud. The reason for this seeming unnecessity is so the subjects internalize the number.
   3. In the third step the subject are asked to write down the number in designated space of the experiment sheet. The reason for the second step of internalizing the anchor is three-fold. The main part is again the remembrance of the anchor and given the outline of the experiment sheet the number will be on the subject's sight for the next step. The third helps with the assessment of the data.
   4. Finally, subjects are asked a question demanding an answer in number which they are requested again to write on the experiment sheet.

The question the subjects were asked was selected carefully in a notion of intention of the subjects guessing, in other words we had to choose a question to which the answer isn't generally known. The following question fulfilled the criteria.

What is your best estimate of the population of Ecuador in millions?

The actual population of Ecuador is 16,279,000. Which is not relevant for the assessment of the results, nevertheless it is the number around which we set the anchors.

Number 5 was chosen as a low anchor and as a high anchor number 26 was chosen number.

b. The second part of the experiment is aiming at the Tversky's (1974) perception of the mechanics of anchoring i.e. anchoring as an adjustment. The experiment was performed using the same experiment sheet. In general, the idea is quite like the first part of the experiment, therefore the subjects are presented an anchor and subsequently asked a question containing number. The difference between the two parts of the experiment is mainly in the way the anchor is presented. Unlike the first part, where the anchor is completely disconnected from the context, we present anchor within the context. The subjects were given experiment sheet either with high or a low anchor. The procedure of inclusion of the anchor into the context is done through presenting pre-question including the anchor. Such a question is generally asked as: Do you think the [field of interest] is greater or smaller than [the anchor]?
   The answers in the pre-question are not important for the assessment of the test and serve purely to internalize the anchor presented in the question.
   To set the high and low anchor subjects are divided into 2 subgroups and presented a variation of 2 questions which only differ in the anchor.
   The experiment is performed individually among subjects where the experimenter serves as an attendant of the course of the experiment.
   The anchoring question was: Do you thing the area in kilometers squared of USA is more, or less than [anchor] times bigger than the area of the Czech Republic.
   The right answer is about 120 times which is again not important in the assessment of the results, however it is the number, from which we derived the anchors.
   The anchors were set 80 as a low anchor and 160 as a high anchor.

2.1.4. Method

For the assessment of the data we have used Microsoft Excel as a tool to perform the analysis. The subjects were assigned numbers 1-14 for the FINs and 15-28 for the nonFINs. Within each group the subjects were divided randomly in the subgroups in which they were presented high or low anchor in the a, part of the experiment and again randomly presented high or low anchor in the b, experiment. The only rule for division to the subgroups was equality in the number of high and low anchors within the groups. The gathered data were adjusted for simplification of calculation through multiplication of high anchor by 1 and low anchor as -1. For the analysis, we have used the aforementioned method of anchoring index for both groups in an adjusted form shown in the following equations:

$$(8)\ AI_{FINs} = \frac{\sum_{i=1}^{14} E_{hi} - \sum_{i=1}^{14} E_{li}}{A_h - A_l} \times \frac{2}{N_{FINs}}$$

$$(9)\ AI_{nonFINs} = \frac{\sum_{i=15}^{28} E_{hi} - \sum_{i=15}^{28} E_{li}}{A_h - A_l} \times \frac{2}{N_{nonFINs}}$$

Where:

E_h… is a response of a subject presented high anchor

E_l…is a response of a subject presented low anchor

A_l… is the low anchor

A_h… is the high anchor

N_{FINs}… is number of subjects in FINs group

$N_{nonFINs}$… is a number of subjects in nonFINs group

The idea of the adjusted formula is incorporating the mean for each group in order to be able to perform hypothesis testing for difference between two means.

The hypothesis stated vaguely is following:

The FINs show lower proclivity to be subject of anchoring.

Formally we state the hypothesis in following manner:

$H_0: AI_{FIN} - AI_{nonFIN} \geq 0$
$H_1: AI_{FIN} - AI_{nonFIN} < 0$

Suitable test for testing the hypothesis is one-tailed two sample t-test hence:

$t = \left[\frac{AI_{FIN} - AI_{nonFIN}}{SE}\right]$

The tricky part here arises when calculation standard deviation, for which we need to group the responses in couples and calculate anchoring index for each one of them, in order to achieve subsample on the sample of responses.
Ultimately rejecting the null hypothesis on level of significance 0.05, hence proving $AI_{FIN} - AI_{nonFIN} < 0$ which in would show that people in direct connection to financial markets are less prone to anchoring bias, hence indirectly more rational in their decision making.
The method of analysis is identical for both sub-experiments the random and adjusting anchor.

2.1.5. The results

Experiment 1A
The assessment of data has revealed following results of the anchoring index

AI_{FIN}= 0.1700680
AI_{nonFIN}= 0.1836734

When testing the difference of anchoring index (as proposed hereinabove) among the two groups the t-statistic is -0.0608 giving the p-value of 0.47 -> it is insignificant on any bearable level of significance, hence we cannot reject the null hypothesis.

The results are generally obvious on the first glance since the anchoring index between the two groups doesn't reveal any notable difference. Unfortunately, we cannot state much with confidence, but it seems the 2 groups are equally biased in their decision

making when being presented random anchor. However, both of the groups slightly low proclivity to anchoring bias from random anchor. For that we test whether they are even subject to anchoring using t- statistic for one-group mean.
The AI for the whole sample is equal to 0.176817 we tested the following hypothesis, formally:

H_0: $AI_{all} = 0$
H_1: $AI > 0$

The t-statistic resulting from this test is equal 1.645 which gives us p-value of 0.06196 at 13 degrees of freedom hence we can reject the null hypothesis and state the alternative hypothesis: The subjects of this experiment are prone to an anchoring bias.
Hence we can come to overall conclusion to this part of experiment, the subjects of the experiment are prone to anchoring and there is no significant evidence of difference among the groups. According to our experiment FINs are, same as nonFINs, rather Human than Homo Oeconomicus when facing random anchor.

Experiment 1B
The assessment of data has revealed following results of the anchoring index

AI_{FIN}= 0.419642857
AI_{nonFIN}= 0.446428571

When testing the difference of anchoring index (as proposed hereinabove) among the two groups (i.e. $AI_{nonFIN} > AI_{FIN}$) the t-statistic is -0.163 giving the p-value of 0.46 -> it is insignificant on any bearable level of significance, hence we cannot reject the null hypothesis.

Once again, as in the random anchor example, it is quite obvious, the anchoring indexes are very close in their values to one another. Unfortunately, we cannot state much with confidence. Expectedly both groups have on the first glance shown higher proclivity towards anchoring bias when facing anchor encoded in context rather than random anchor for evidence of this phenomenon we will test following hypothesis:

H_0: $AI^{random} - AI^{nonrandom} \geq 0$

H_1: $AI^{random} - AI^{nonrandom} < 0$

Where AI^{random} is the anchoring index on the whole group of participants in the experiment 1A and $AI^{nonrandom}$ is the anchoring index among the whole group of participants in the experiment 1B. The alternative hypothesis is thus, People (regardless their occupation) show higher proclivity to anchoring bias when presented. The anchoring indexes computed on the whole sample were following:

$AI^{random} = 0.176871$

$AI^{nonrandom} = 0.433035714$

The hypothesis was testes using one-tailed t-test for difference in means. The t-stat had a value of -1.92278637 which with 23 degrees of freedom gives is p- value of 0.0334. Hence we can reject the null hypothesis proving the alternative hypothesis of $AI^{nonrandom} > AI^{random}$ at more than 95% confidence.

Altogether in the 1B experiment we have shown that there is no significant difference among the groups of FINs and nonFINs in proclivity to Anchor within context i.e. adjusting anchoring given our evidence.

Concluding both parts of the experiment we have shown the groups of nonFINs and FINS do not differ in proclivity to anchoring biases regardless whether the anchor is random or presented in the context. Furthermore, we have proved the existence of anchoring bias is present in both groups regardless of presenting, however the proclivity to anchoring bias in within context presentation of anchor is significantly greater, showing both of the groups are rather Human than Homo Oeconomicus.

2.2. Prospect theory and Mental accounting questionnaire

The following questionnaire is based on assumptions arising from the Prospect Theory as proposed by Kahneman and Tversky (1979) as well as the theory of Mental Accounting proposed by Thaler (1985)

2.2.1. The aim of the questionnaire

The aim of the questionnaire or the observed phenomena are in fact similar to foregoing experiment, therefore to collate responses of sample of subjects involved in the financial markets to a sample of subjects not involved in them. The questions were carefully selected to aim at partial components of both theories, altogether revealing whether the respondents' preferences are aligned with behavioral theories or conversely to the theory of expected utility. In other words, once again we are trying to reveal whether the subjects within the groups are approaching the phenomenon of Homo Oeconomicus or vice versa the Human. In the following sections, we will present the composition of the sample as well as the contents of the questionnaire and incorporate the questions in the context of observed phenomena.

2.2.2. The Subjects

The subjects were approached in three major streams, via e-mail, personally/phone and through company groups in social media.

The subjects in the questionnaire were as in the previous experiment divided into two groups. Combined the number subjects responding the questionnaire reached 68. For the purpose, of the following text we will call those groups FINs, for the subjects involved in the financial markets, and nonFINs, for those who don't belong in the first group.

The group of FINs consisted of 26 subjects.(i.e. 38.3% of the overall sample). Unlike the previous experiment where the subjects were approached in person, we cannot precisely state the frequencies of occupations of subjects within the group of FINs due to the fact, that some of the subjects arise from aforementioned social media groups, and marginal part arise though snowballing method when the questionnaire link was passed subject-to subject. However, we can say the group of FINs was generally diverse in a form in which the participants involve in the financial markets. For where we can reach, the sample consisted of mergers & acquisitions advisors including a partner of mergers & acquisitions team of one of the major consultancy firms, CFOs of firms in variety of industrial fields, traders from investment banking department of one of the major Czech banks, and aside from those who are involved professionally, there were again those who trade as their secondary income either commodities, FOREX or cryptocurrencies.

The group of nonFINs didn't have any limitation for participation, except for not being involved in the financial markets decisions as a trader, investor or advisor. Hence the group includes variety of occupations and even students.

2.2.3. The design, method and results

(see the questionnaire in appendices)

Altogether the questionnaire consisted of 15 questions. The very first question was only aiming at the division into subsamples, therefore asking if the subject falls in the category of FINs as defined hereinabove or vice versa. Following questions then aimed at the partial components of above mentioned theory, out of which 10 were aimed at the components prospect theory and 4 at the components of mental accounting. Some of the questions were solitary, meaning the inference could be drawn on the proportions of answers on the particular question, and some were compound of two questions generally aiming at the consistency of responses when the question was framed differently in the second case. In the following sections, we will analyze the questions in connection to the partials of the presented theory as well as explain the logic behind them.

In the first block of questions (i.e. 10) subjects were asked: "Consider following options which one would you rather choose?", and consequently offered options of either two gambles (games of chance) or a combination of a gamble and a sure payoff. It is important to state that gambles weren't rewarded with a real payoff, but were strictly presentation of hypothetical situations.

The first two questions in the block of the Prospect Theory aiming questions of the questionnaire formed the aforementioned compound.

In the first of the questions (1) subjects could have chosen between a game of chance with payoff 40,000 CZK with .8 probability of winning (A) (hence the expected value of the gamble was 32,000CZK), and a sure payoff of 30,000 (B).

In the second question of the compound (2) subjects were asked to choose between playing game of chance with payoff 40,000CZK with .2 probability (C) (hence the expected value was 8,000CZK) and game of chance with payoff 30,000 with .25 probability (D) (hence the expected value was 7,500CZK).

In the first of the two questions, according to the expected utility theory risk neutral as well as risk seeking subjects should definitely choose a game of chance with expected

payoff 32,000 CZK as for risk averse subjects it depends on the level of their risk averseness, but are expected to rather choose the sure option. The trick when setting the second question is that the probability values of both options are nothing else but multiplication of the probabilities in the previous problem by the coefficient .25, hence the chosen options of one subject between the questions shouldn't differ according to the expected utility theory, since the relative payoffs of both options didn´t change between the questions, i.e. the substitution axiom of expected utility theory, which when applied on those two questions means, whatever is preferred in the first question should be consequently preferred in the second question since it is only a mixture of probabilities. Hence, the question was mainly aimed to reveal a component of a prospect theory called certainty effect when the subjects would systematically overvalue sure outcome which they reveal as soon as both outcomes are lowered by the same proportion.

The idea of the assessment is then the subjects choosing A in question 1 should consequently choose C in question 2 and vice versa, if they are behaving in accordance to expected utility theory. The results are presented in the following table

Table 1 – Questionnaire results 1

Questionnaire results 1 Question Compound 1					
Question	Question 1		Question 2		Human behavior
Answers	A	B	C	D	
FINs	35%	65%	77%	23%	50%
nonFINs	24%	76%	71%	29%	67%

If we look at the first question we can see that both groups preferred the sure deal over a gamble. When analyzing the groups one by one FINs have shown less proclivity to risk averseness as compared to nonFINS. The second question has as we expected according to prospect theory partially flipped the preferences of both groups, which in general corresponds with the findings of Tversky and Kahneman (1979).

For our purpose, we had to define a binary variable X_s^q the values are of course either 1 or 0, the q stands for the number of question compound (or question) hence in this case we are looking at X_s^1, and s is a subjects number, which also divides the sample in FINs (1-26) and nonFINs (27-68). The values of X_s^q were then assigned according to their compound behavior in the two consecutive questions meaning 0 is behavior in accordance with expected utility theory (in this case answers [A;C] or [B;D]), and 1 is behavior in

accordance with the prospect theory or further theory of mental accounting (hereinafter Human behavior).

Consequently, summing the binary variable gave us results of the proportion of Human behavior in the group, in this particular case the presence of certainty effect as a violation of substitution axiom of expected utility theory.

According to the results in the question compound 1 the FINs have shown lower proportion of Human behavior with 50% as compared to nonFINs with 67%. However, this result doesn't really point towards direction of FINs following concept of Homo Oeconomicus in a face of certainty effect, it just shows they are slightly closer to the concept.

The second question compound is aiming at possible violation of substitution axiom of the expected utility theory other than certainty effect, it is a change of preferences when facing a gamble with "possible" probabilities and equal expected value people tend to choose option with higher probability, on contrary when the probabilities lower to merely possible level people start deciding according to the values assigned to each gamble.

In the first question (3) the subjects were presented two games of chance, winning 60,000CZK with .45 probability (E) or winning 30,000CZK with .9 probability (F). Both of the options had hence expected value of 27,000CZK.

In the second question (4) the subjects were also presented two games of chance, winning 60,000CZK with 0.001 probability to win (G) or winning 30,000CZK with 0.02 probability to win(H). Both options had hence expected value of 300CZK.

As in the previous question compound the subjects behaving according to expected utility theory should be consistent in their responses, i.e. choosing either [E;G] or [F;H].

The results are presented in the following table

Table 2 – Questionnaire results 2

Questionnaire results 2 Question Compound 2					
Question	Question 3		Question 4		Human behavior
Answers	E	F	G	H	
FINs	15%	85%	69%	31%	62%
nonFINs	14%	86%	90%	10%	76%

Interestingly, if we put the groups together the results are almost identical with results of Tverky and Kahneman (1974) If we look at the question 3 the proportion of answers is almost identical among the two groups. Meaning both groups prefer the option F i.e. the option with higher probability of winning. In question 4 the preferences have switched towards higher value despite the same relative probabilities. This finding is in accordance with the prospect theory.

Focusing individually on each group, we must state that the reverse of preference has occurred in both. As in the first compound question we have assigned the binary variable X_s^2 to each of the subjects where the Human behavior value of 1 was assigned if the answers were [E;H] or [F;G] and expected utility value of 0 vice versa. Majority in both groups have behave in discordance to concept of Homo Oeconomicus. However, same as in the first compound question the FINs have shown slightly lower proportion of Human behavior within their group.

The third question compound (third we analyze – not third in the questionnaire) aiming at the core of the prospect theory, i.e. the concavity of value function in gains and convexity losses. The question compound is analogical to the Problem 7 presented in the theoretical part of the paper, only the numbers are multiplied by ten and denoted by local currency in order to fit the setting.

In the first question of the compound (5) the subjects were asked to decide between two gambles. The first gamble offers winning 60,000CZK with .25 probability to win (I), the second gamble offers winning of 40,000CZK with .25 probability or 20,000CZK also with .25 probability(J), hence both of the options have expected value 15,000.

In the second question of the compound, subjects were offered analogical possibilities, however in this case denoted as negative numbers hence losses (denoted first option K second L). Once again Homo Oeconomicus would be consistent in her answers of the two questions and Human would behave according to the prospect theory. The results are presented in the following table:

Table 3 – Questionnaire results 3

Questionnaire results 3 Question Compound 3					
Question	Question 5		Question 6		Human behavior
Answers	I	J	K	L	
FINs	27%	73%	46%	54%	50%
nonFINs	26%	74%	55%	45%	48%

The question 5 has gone as expected the subjects of both groups have chosen the option that offered higher probability of winning at least some amount. However, in the question 6 the results are not approaching proportions sufficient to assume the subjects behaved in accordance with prospect theory. The proportion of subjects shows human behavior was almost precisely 50% in both categories. However, what the results show us is that regarding this specific problem both groups behave in harmony regardless of involvement in the financial markets.

The fourth question compound is aimed at altering subjects' responses based on presentation of the options and question per se. The question reveals two components of prospect theory i.e. the isolation effect, where subjects ignore change of setting and the reflection effect which is an exhibition of risk averseness in positive prospects (gains) and risk seeking in in negative prospects (losses). The assumption is that subject who are not aligned in their decisions with the concept of Homo Oeconomicus, would first ignore the change of setting and secondly reveal the change in attitude towards risk in their decision. The questions within the compound are following.

In the first question (7) subjects were put in the setting where in addition to whatever they own they are given extra 10,000CZK and with this newly gained wealth they are offered two options of games of chance. The first option is playing a game of chance with 50% chance to win another 10,000CZK (M), so their overall expected gains from this game would be 15,000 CZK. The second option was sure gain of 5,000 CZK (N). As we have seen in the previous examples we expect the subjects to choose the sure gain, which by itself is even in accordance with expected utility theory.

The second question (8) imposes different setting on the subjects, thus they are given hypothetical 20,000 CZK before the choice. Subsequently, the subjects are asked to decide among the following prospects. Playing game of chance to lose 10,000CZK with .5 probability (O) or to lose 5000 for sure (P).So once again the expected overall payoff of the both games of chance is once again 15,000CZK The results of this question compound are presented in the following table:

Table 4 – Questionnaire results 4

Questionnaire results 4 Question Compound 4					
Question	Question 7		Question 8		Human behavior
Answers	M	N	O	P	
FINs	31%	69%	69%	31%	38%
nonFINs	40%	60%	62%	38%	55%

The question 7 has shown once again in accordance with Tversky's and Kahneman's (1974) discoveries that subjects are risk averse in gains as expected. In both groups subjects preferred the sure outcome of 500 (altogether 1500). Interesting point to observe is the question 8. As stated before all four games within the question 7 and 8 had equivalent expected payoffs so those who have chosen the game M in the question 7, should according to the expected utility theory consequently choose option O in the question 8. However, as in the previous cases this hasn't happen again, which again contributes to the validity of the prospect theory. The two-fold misperception has worked out as designed for the nonFINs, who in the majority of cases deviated from the consistent preferences. However, as for the FINs 72% remained consistent in their preferences showing both less risk seeking in the negative domain as well as including the additional endowment in their calculations. Once again FINs have proven to be slightly closer to the concept of Homo Oeconomicus in their decisions.

The last question compound is aimed at weight of probabilities which enter the value function of the Prospect Theory as an additional weighting function of subjective perception of probabilities as stated in the previous sections of this thesis. The form of the question compound if applied on the real life situation simulates insurance of some very improbable event on the losses side and a lottery ticket on the gain size. The first question of the compound offered following options either playing a game of chance to win 50,000CZK with .0001 probability (Q) or alternatively getting 50 CZK for sure (R). The second question offered analogical options on the negative domain i.e. in losses (denoted S and T). The expectations in this particular question compound are subjects preferring game of chance in positive domain , which is in dispute with previously stated risk averseness in gains, however the reason for that is the lottery ticket effect where the value of offered payoff despite being merely possible weights over the sure payoff of 50,

Which is in accordance with weighting function as proposed by Kahneman and Tversky (1979), where probabilities are generally perceived higher in the are of extremely low probabilities. However, in this case in accordance with expected utility theory considering risk averseness would be in both cases the sure option (i.e. [R;T]) and considering risk seeking it would be the gamble at both (i.e. [Q;S] The results are presented in the table below:

Table

Questionnaire results 5 Question Compound 5					
Question	Question 9		Question 10		Human behavior
Answers	Q	R	S	T	
FINs	65%	35%	27%	73%	77%
nonFINs	86%	14%	29%	71%	81%

In the last compound question, subjects of both groups showed the behavior in accordance with the Prospect Theory. Given the results, making comparisons among the group of FINs and nonFINs is in vain in this particular case. Both groups scored high in both measures which are the propoertions of answers as well as the Human behavior indicator, as a measure of consistency overweighting extremely low probabilities in both cases and actually scored highest in the Human behavior index in comparison with previous questions.

This particular case explains phenomena of lottery tickets as well as insurance of low probability events. The results have shown that when facing similar problem both groups are acting closer to the concept of Human rather than calculating Homo Oeconomicus with stable preferences.

2.2.4. The Human Index

Concluding the hereinabove discussed topic a tool had to be developed to assess the overall proclivity towards either concept of Homo Oeconomicus or Human, on the basis of the Prospect Theory.

I have decided to call the tool the Human Index since its main purpose is to quantify the groups propensity to behave according to the concept of Human.

Returning to the beginning of this section we have defined a binary variable X_s^q, which by definition is getting values of 0 and 1 accordingly to the subjects' behavior in the question compounds. During the assessment of the acquired data we have essentially acquired a matrix of 0s and 1s of 68 rows (the number of subjects responding the questionnaire) and 6 columns (the number of question compounds).Let Q denote the number of question compounds.The subjects were ordered according to group they belong in, resulting in $s\epsilon\langle 1;26\rangle$ corresponding to the group of FINs and $s\epsilon\langle 27;68\rangle$ corresponding to the group of nonFINs. Finally we need to define variable for the groups. Let S_{FIN} denote the number of subjects in the group of those being involved in the financial markets and S_{nonFIN} for those not being involved. We can define the Human Index formally:

$$(10)\ HI_{FIN} = \frac{\sum_{q=1}^{Q}\sum_{s=1}^{S_{FIN}} X_s^q}{Q \times S_{FIN}} \epsilon\langle 0;1\rangle$$

$$(11) HI_{nonFIN} = \frac{\sum_{q=1}^{Q}\sum_{s=S_{FIN}}^{S_{nonFIN}} X_s^q}{Q \times (S_{nonFIN} - S_{FIN})} \epsilon\langle 0;1\rangle$$

The extreme values are 0 for whole group responding in all question compounds as Homo Oeconomicus and 1 responding in all questions as Human.

The values of HI arising from our questionnaire are following:

$HI_{FIN} = 0.461538$

$HI_{nonFIN} = 0.543651$

Testing for difference of means

$H_0: HI_{FIN} \geq HI_{nonFIN}$

$H_1: HI_{FIN} < HI_{nonFIN}$

We can reject the null hypothesis at .10 significance (p-value is .51309) hence we can state the alternative hypothesis that $HI_{FIN} < HI_{nonFIN}$ and is so significantly.

Hence we can state the subjects involved in the financial market are more aligned with the concept of Homo Oeconomicus, however despite being significant in statistical term the difference is not stunning to the point where we could call the FINs as fully rational in traditional economics terms, what we have shown here is only a slight difference.

Mental Accounting Intuition among FINs and nonFINs

Unlike, the previous questions in the following section subject were asked to judge wellbeing of heroes in different situation. The heroes in the stories were facing situations which in conclusion bring exactly equivalent financial outcome. The idea was borrowed from Richard Thaler's (1985)experiment conveyed on a group of 87 students of Cornell University. Unlike the previous section where the subjects were judging which gamble is more appealing to them, in this section we are interested in their intuition of cases where Mental Accounting concepts are somehow encoded. As in the previous set of questions our aim was to fathom whether the subjects respond in alignment with the presented theory or against it. Since the outcomes of the stories are financially equivalent we would expect FINs given the assumption that they are closer to the concept of Homo Oeconomicus being generally more pragmatic and judging the stories only with respect to the values assigned, hence judging the wellbeing as equivalent in all cases, alternatively mind of a Human should focus more on the way questions are frames and accordingly should aligned with the theory of mental arithmetics i.e. segregate gains, integrate losses, cancel loss against larger gain and segregate so called "silver linings"(i.e. small reduction in absolute value of loss), and consequently project those principles in assessing the subjective values of the heroes of the stories.

The questions were following (for the exact wording of the questions see appendices)

In the first question (Question I.) subjects were asked to judge who is "Happier" Jimmy or Timmy. Jimmy has two separated gains in stock market trading (31USD and 42 USD) and Timmy has one gain from trading (73USD) which is only a sum of the gains Jimmy has acquired. According to the Transaction Utility Theory proposed by Thaler (1985) as well as the shape of value function of prospect theory subject should perceive Jimmy to be happier due to phenomenon of segregation of gains and steeper value function in the area closer to the reference point. The results were following.

Mental arithmetics 1			
Questions	Question I.		
Answers	A	B	C
FINs	42%	12%	46%
nonFINs	24%	17%	60%
Both	31%	15%	54%

The answer A means subject perceive Jimmy the "happier" of the couple, B states vice versa and C denotes no difference. Interestingly, we have got majority of respondents choosing no difference, regardless of group and consequently for both FINs and nonFins combined. Suprisingly the nonFINs unlike in all previous assessments have shown higher proportion of Homo Economics' perception of world. Altogether we cannot state that our gathered data would justify subject perceiving segregated gains as more appealing, bringing higher utility, as integrated gains. The majority sees the outcomes as indifferent, hence in accordance with expected utility theory.

In the second question (Question II.), we oriented our focus to losses, where similar as in the previous example we would like to see whether the subject will perceive the situation in the eyes of Homo Oeconomicus or alternatively as Human. Hence opposite to the previous example subjects were judging who of the heroes is more upset (in economic terms, who has higher negative utility from the setting. The question was stated in the following manner: Hana got two separate penalties for parking and speeding amounting 20USD and 55USD. Lana on the other hand got only one for reckless driving amounting 55USD. The question of who is more upset had following responses.

Mental arithmetics 2			
Questions	Question II.		
Answers	A	B	C
FINs	58%	8%	35%
nonFINs	36%	21%	43%
Both	44%	16%	40%

The answer A means Hana is more upset B lana is more upset and C denotes no difference. The expected outcome according to the theory should be A i.e. segregated losses bring higher negative utility i.e. agents in economy should prefer to integrate them. Opposing our hypothesis the FINs have shown stronger alignment with the presented theory as compared to nonFINs, i.e. the majority voted A. However nonFINs haven't shown

significant alignment with the theory of mental accounting, furthermore their responses were rather dispersed which doesn't leave sufficient space for broader inference.

In next two questions the gains and loss scenarios were mixed the aim was hence to reveal perception of FINs and nonFINs and it comparison.

In the third Question (Question III.) the combination is overall gain (including smaller loss) or just simple gain. The presented scenario was following. Larry found 100USD on the street, but also managed to cause himself a damage of 50USD leaving him with 50USD of gains. Terry has found 50USD. Again the subjects were asked about their wellbeing. According to the theory in this case the loss should be integrated in order to achieve higher utility, it is caused by the steeper value function in the negative domain. Hence the option that should be preferred by subjects thinking in terms of the transaction utility theory should be Terry enjoying higher utility or in the words of the questionnaire- "Hapiness" the results were following.

Mental arithmetics 3			
Questions	Question III.		
Answers	A	B	C
FINs	8%	85%	8%
nonFINs	19%	67%	14%
Both	15%	74%	12%

Finally, in the third question the answers aligned precisely with the theory. Both FINs and nonFINs shows their perception of the presented situation to be in accordance with the assumption that smaller losses should be integrated in larger gains for the maximized utility. Once again the nonFINs have shown weaker alignment with the assumption as compared to subjects involved in the financial markets. However, such situation is generally common to the agents in financial markets, hence what they essentially said is they themselves prefer to win smaller amount than to see for a short time unit excessive gain which they consequently lose. Once again our hypothesis of FINs being closer to the concept of Homo Oeconomicus, was partially disproved by nonFINs behaving more in accordance with that phenomenon but generally can be said, that this particular question only proved Thalers' (1985) theory.

In the last question of we aim at the perception of the concept of "silverlining" i.e. a small gain over larger loss setting. The question presented to the subjects was following. The heroes of the scenario were Chuck an Doug. Chuck experienced damage that cost him 250USD but at the same time he has won 50USD leaving him with overall loss of 200USD. On the other hand Doug only experienced damage equal to 200USD. According to the theory of Transaction Utility it should be Doug who is more upset because he doesn't experience the "kick" of utility arising from the steep part of value function in the area close to the reference point. In the words of transaction utility, he is not experiencing the overall change being segregated, hence is a subject to higher disutility. The results are presented bellow

Mental Arithmetics 4			
Questions	Question IV.		
Answers	A	B	C
FINs	19%	65%	15%
nonFINs	24%	17%	60%
Both	31%	15%	54%

As in the previous examples we see FINs following the assumptions based on Thaler's theory i.e. majority voting for the option of Doug being more "upset". The answers of nonFINs are aligned with the phenomenon of Homo Oeconomicus and see the outcome solely on the basis of compound loss with 60% of them not seing difference. Once again our hypothesis was partially disproved.

Altogether the intuition of FINs as compared to nonFINS, has been quite adverse to what we had expected. The overall results are presented below:

Mental arithmetics overall													
Questions	Question I.			Question II.			Question III.			Question IV.			HI
Answers	A	B	C	A	B	C	A	B	C	A	B	C	
FINs	42%	12%	46%	58%	8%	35%	8%	85%	8%	19%	65%	15%	74%
nonFINs	24%	17%	60%	36%	21%	43%	19%	67%	14%	24%	17%	60%	64%
Both	31%	15%	54%	44%	16%	40%	15%	74%	12%	31%	15%	54%	69%

Focusing on the Human Index in the right part of the table we can see the sides of Rationality have changed to the opposite direction as in the previous two sections of comparing FINs and nonFINs suddenly the nonFINs seem to be more in accordance with being rational. Unfortunately, we don't have a capacity to reveal what has caused the sudden shift, the reasonable explanation could lie in the framing of the questions where in the previous section subjects were asked to decide which prospect to chose which they translated to their minds which one is going to bring me more utility and once they have decided they kept the preferences to the next round of the similar question, whereas in the case of the stories or scenarios, they somehow approach it with relaxed mind- we could say system 1 thinking where they use availability heuristic to offer them what has made them upset or happy. Could be that it is the usage of the words happy and upset automatically launches system 1 thinking in order to make the judgment.

2.3. Key findings

In alignment with the general hypothesis of the thesis, we have observed agents in financial markets (FINs) and group not involved directly in them (nonFINs), in order to detect whether the FINs are closer to the phenomenon of Homo Oeconomicus.

In the anchoring experiment where the subjects were firstly presented random anchor followed by an anchor within the context, subjects in both cases revealed being close to the concept of Human. The results were assessed using the Anchoring index as presented in the theoretical part of this thesis. The differences among the two groups weren't significant in either case, however the proclivity to biasedness was significantly greater, when presented anchor within the context. Hence the conclusion with respect to anchoring, is that the FINs as well as nonFINs are prone to bias of anchoring at very similar, close to equal level.

In the part of the questionnaire testing subjects' decisions based on the hypothetical payoffs of prospects, we have designed an index of proclivity to phenomenon of Human based on the overall score with alignment to Prospect theory, which we called Human Index (HI). From the analysis of gathered data we have found that FINs reveal significantly lower propensity to decide in accordance with the Prospect theory, hence decide more on the bases of the Expected utility theory than their counterparts nonFINs. Which is in alignment with our hypothesis. However, both of the groups have shown strong propensity towards deciding in alignment with the Prospect Theory.

In the second part of the questionnaire testing subjects' perception of utility in situations presented in short scenarios of combinations of gains and losses. Frankly the assessment has shown that nonFINs are more likely to decide based on values rather than to respond to the framing of the questions as compared to their FINs counterparts, however as in previous cases and according to the HI both of the groups were in alignment with the presented behavioral theory.

Altogether it seems that FINs as well as nonFINs are rather Human than Homo Oeconomicus and the only area in which the FINs are closer to being Homo Oeconomicus, is the decision among prospects directed at them, i.e. deciding based on Expected utility theory in those cases. However, it seems that altogether, there is not significant behavioral difference between the two groups.

Conclusion

The phenomenon of Homo Oeconomicus as a cornerstone of mainstream economics is indispensable tool in the composition of economic models. Due to its predictability from the perspective of the economist as well as the absence of deviations from rationality it has been handy to use the concept throughout the evolution of economic theory. However, as every student of economics in the freshman year would tell you it is quite demanding to imagine such an agent in actual real world economy, in fact I do believe, that it is the slight disconnection from the reality that is most difficult for students in the first year to grasp and limit their thoughts of world in economic models based on "ceteris paribus" and Homo Oeconomicus assumptions. Thanks to a progress in psychology of decision in the mid-20th century, and the imaginary marriage of psychology and economics a new academic field has emerged- the behavioral economics. The behavioral economics no longer ignores the human traits of an individual in economy and allows for a concept of Human, which is by definition capable of calculating errors and being affected by seemingly irrational exogenous circumstances that bias his decicion.

However, there are some fields in which we expected the agents to show higher dosage of rationality. One of such areas are financial markets, whose agents we have chosen to observe. The motivation for observing this particular field has been driven by my current occupation in transaction advisory, where I had certain notion of certain irrationalities occurring, and hence was motivated to research what are the causes of such biases and

whether the people in financial markets are less prone to the due to their constant training in pragmatic thinking and analytical background.

In the theoretical part of the thesis we have covered main types of biases that could be present in the financial markets and build theoretical background to finally get to behavioral view at the decision under risk the Prospect Theory as proposed by Kahneman and Tversky (1979) and Mental accounting proposed by Thaler (1985). Before getting to the biases we have defined a concept of two systems of thinking one slow, analytical, deliberate and disponing computational abilities as we can see in the concept of Homo Oeconomicus,but more importantly we have defined the so called system 1, an automated system working mostly in subconscious mode and is the ultimate cause of biasedness in perception and decisions we can see in the financial markets as well as in any aspects of decisions in the real world. Among the biases we have covered were anchoring, misperception of statistics resulting in so called gambler's fallacy and herding. The anchoring as one of the biases that are conveniently measurable was used in our experiment, and its presence in the financial markets can be seen especially in a form of within context bias where traders, or investors take past prices or bidding price as an anchor and adjust their decisions around the anchor. Herding is especially common in the financial markets and its presence was proven by Ivo Welsh (2000) who researched herding among the group of major security analysts on NYSE. Herding is also wastly present among small traders in commodity, security and cryptocurrency markets, where there is a common presence of leading agents whose behavior and decisions are closely observed by smaller traders and consequently mirrored causing herd movements of the agents. Gamblers fallacy, as a result of misperceiving statistics, can be seen again in trading where the traders believe in repeating cycles around steadily growing or decreasing value of security, commodity, currency or cryptocurrency and make their decisions based on the changes of the tangent of the curve.

Ultimately we have defined behavioral concept of decision making theory – the prospect theory and consequently its extension the mental accounting, which had both evolved as a critique of widely used expected utility theory. The basic idea of those theories states that at each decision we do not decide only based on the expected outcomes but in connection to our reference point (i.e. current state of wealth), most importantly offers a solution to different changes in utility with respect to gains and losses, and also gives notion to it's not only the compound value of change of wealth, but also the way problem is framed and the combinations of units of change of the compound. I personally find the

theory to be reflecting reality in a good manner and see its presence partly in the financial markets in form of loss aversion.

In the practical part, we observed the differences in thinking and decision making between agents in financial markets (FINs) and group not involved directly in them (nonFINs) in alignment with the hypothesis of FINs being closer by their behavior to the concept of Homo Oeconomicus.

Firstly, using the experiment we observed their deviations from rationality, or in other words proclivity to system 1 thinking, based on subjects' tendency to include an anchor in their decisions. In the random anchor experiments both of the groups have shown propensity to commit a bias of anchoring measured by the anchoring index in a value of approximately .20, however there was no statistically significant difference among the two groups in the values of anchoring index. Following within context anchor experiment has revealed, the propensity to committing anchoring bias based on context anchor is greater as compared to random anchor, this difference was statistically significant. However once again there was no evidence of the FINs being systematically more rational as compared to their nonFINs counterparts.

Secondly we focused on the decision making of a different sets of subjects, but still divided into groups of FINs and nonFINs with respect to behavior in alignment of a prospect theory, where we tested the consistency of responses in the different framings of prospects as the theory suggests. For the assessment of the results we developed so called Human Index which was consequently applied. The results showed that FINs are more aligned with the expected utility theory as compared to their nonFINs counterparts and this result was statistically significant. However despite the significance the difference was rather minor.

Finally, the same subjects as in the previous example have been tested in their perception of Thaler's (1985) Mental accounting with respect to segregation and integration of gains and losses. In this last test the FINs have shown to perceive the problems in alignment with the presented theory in most cases and scored significantly higher in the Human Index score.

Altogether the hypothesis of FINs being more rational has shown to be erroneous. Not only shows that both of the groups FINs and nonFINs are in its core rather Human than Homo Oeconomicus, further more there is no significant difference between the two groups. Meaning essentially that FINs are just as Human as nonFINs.

In the end, I believe that there is not a real need to revisit the topic per se after all what has been shown here is it is evident that we are all rather Human than Homo Oeconomicus. What could be done further is harvesting the fact and impose further research of how to use the biases of others in order to maximize oneselves profit, or further research of possibilities of nudging in the financial markets.

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Appendices

- Appendix A – The anchoring experiment sheet
- Appendix B – The responses of the anchoring experiment
- Appendix C – The questionnaire

Appendix A

Experiment 1/a

Subject:

A/B

1. Draw a random number from a hat

2. Write down the drawn number below:

3. What is your estimate of the population of Ecuador in millions?

Write down your answer below:

Experiment 1/b

Subject:

A/B

1. Do you thing the area (in km^2) of USA is more, or less than 80 times bigger than the area of Czech Republic?

Highlight your answer in circle:

a. More
b. Less

2. How many times is USA bigger than Czech Republic? (your best estimate)

Write down your answer below (as a number):

Experiment 1/b

Subject:

A/B

1. Do you thing the area (in km^2) of USA is more, or less than 160 times bigger than the area of Czech Republic?

Highlight your answer in circle:

c. More
d. Less

How many times is USA bigger than Czech Republic? (your best estimate

Write down your answer below (as a number):

Appendix B

Experiment 1/a - Anchoríng Response sheet/ calculations					
Subject group FINs			Subject group nonFINS		
Subject	Anchor	Response	Subject	Anchor	Response
1	26	8	15	5	8
2	26	34	16	5	9
5	26	15	19	5	11
6	26	12	20	5	15
9	26	7	23	5	14
10	26	8	24	5	7
14	26	25	28	5	11
3	5	15	17	26	18
4	5	12	18	26	10
7	5	9	21	26	17
8	5	11	22	26	12
11	5	10	25	26	14
12	5	17	26	26	12
13	5	10	27	26	19

Experiment 1/b - Anchoríng Aggregated Response Sheet					
Subject group A	e		Subject group B		
Subject	Anchor	Response	Subject	Anchor	Response
2	160	80	16	160	95
5	160	130	19	160	130
7	160	120	21	160	100
10	160	115	24	160	100
6	80	70	20	160	140
9	80	90	23	160	120
13	80	100	27	160	90
4	160	110	18	80	100
8	160	100	22	80	50
14	160	130	28	80	65
1	80	70	15	80	80
3	80	85	17	80	70
11	80	75	25	80	90
12	80	60	26	80	70

Appendix C

Questionnaire Robert Vácha

Following questions are not aimed to test your knowledge or skills in mathematics or statistics.
Please imagine how would you decide facing similair situation and answer accordingly.
To finish the questionnaire please answer all of the questions herinunder.
All of the proposed games are played only one round.
Thank you for you time.

Robert

*Povinné pole

Please choose a category in which you belong. *

- ◯ Involved in trading in financial markets.Involved in mergers and acquisitions as an advisor, investor, manager of a fund etc.
- ◯ none of the above

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 80% chance of winning 40,000CZK
- ◯ Getting 30,000CZK for sure

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 20% chance to win 40,000CZK
- ◯ Playing a game of chance with 25% chance to win 30,000CZK

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 45% chance to win 60,000CZK
- ◯ Playing a game of chance with 90% chance to win 30,000CZK

Consider following options which one would you rather choose ? *

- ◯ Playing play a game of chance with 0.01% chance to win 60,000CZK
- ◯ Playing a game of chance with 0.02% chance to win 30,000CZK

In addition to whatever you own, you have been given 10,000CZK. Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 50% chance to win another 10,000CZK
- ◯ Getting 5,000CZK for sure

In addition to whatever you own, you have been given 20,000CZK. Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 50% chance to LOSE 10,000CZK (otherwise you dont lose anything)
- ◯ Losing 5,000CZK for sure

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 25% chance to win 60,000CZK (otherwise you don't win or lose anything)
- ◯ Playing a game of chance with 25% chance to win 40,000CZK and 25% chance to win 20,000CZK (otherwise you don´t win or lose anything)

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 25% chance to LOSE 60,0000CZK (otherwise you don't win or lose anything)
- ◯ Playing a game of chance with 25% chance to LOSE 40,000CZK and 25% chance to LOSE 20,000CZK (otherwise you don´t win or lose anything)

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 0.01% chance to win 50,000CZK
- ◯ Getting 50CZK for sure

Consider following options which one would you rather choose ? *

- ◯ Playing a game of chance with 0.01% chance to LOSE 50,000CZK
- ◯ Losing 50CZK for sure

In the following questions decide who is “happier” or "more upset" in a given situation. The financial incomes from situations is equal between the 2 people in every question.

1. Jimmy sometimes trades stocks on his phone as a secondary income. One day he bought couple stocks of Apple and Exxon in the morning and when he got back to his phone he found out his position on Apple made him USD31 and Exxon made him USD42. He sold both so it became his gain.
2. Timmy trades stocks as a secondary income. One day he bought couple stocks of Apple and later found out his position appreciated by USD73. He sold it so it became his gain.

Who is happier Jimmy or Timmy? *

- ◯ A. Jimmy is happier
- ◯ B. Timmy is happier
- ◯ C. They are both equally happy

Hana and Lana

1. Hana went to mailbox one day and found out there are two letters one from the municipal police the other one from the state police. After opening them she found out the municipal police fined her USD20 for prohibited parking and state police fined her USD35 for speeding.
2. Lana went to mailbox one day and found out there is a letter from the state police after opening she found out she was fined USD55 for reckless driving.

Who is "more upset" Hana or Lana? *

- ◯ Hana is more upset
- ◯ Lana is more upset
- ◯ They are both equally upset

Larry and Terry

1. Larry found USD100 on the street and stepped in a muddy paddle and destroyed his shoes worth USD50.
2. Terry found USD50 on the street.

Who is "happier" Larry or Terry *

- ◯ Larry is happier
- ◯ Terry is happier
- ◯ They are both equally happy

Chuck and Doug

1. Chuck's car was damaged and he had to pay USD250 to repair it. On the same day he won USD50 in a Casino
2. Doug's car was damaged and he had to pay USD200 to repair it.

Who is "more upset" Chuck or Doug? *

- ◯ Chuck is more upset
- ◯ Doug is more upset
- ◯ They are both equally upset

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